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THE
GEOGRAPHICAL REVIEW

VOLUME X

JULY-DECEMBER, 1920

PUBLISHED BY
THE AMERICAN GEOGRAPHICAL SOCIETY
BROADWAY AT 156th STREET
NEW YORK

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The Society is not responsible for the opinions or the statements of writers in the Review

Published monthly by the American Geographical Society
Broadway at 156th Street, New York, N. Y.

Price, fifty cents a number — Five dollars a year

Entered as second-class matter, January 22, 1916, at the Post Office at New York, N. Y., under the Act of August 24, 1912

Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 30, 1918

The Waverly Press, Baltimore

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Mr. Verner has traveled extensively in tropical Africa and tropical America and made a special study of the pygmies in the former region. He has written "Pioneering in Central Africa" (Richmond, Va., 1903) and "The Effective Occupation of Undeveloped Lands" (*Bull. Amer. Geogr. Soc.*, Vol. 42, 1910).

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Map of Eastern Labrador, by Mrs. Leonidas Hubbard, Jr. 1:1,584,000. 1906. Embodies original survey of the George and Nascaupee Rivers across eastern Labrador from Ungava Bay to the Atlantic.

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Mercator's Map of the World, 1538. Facsimile in black-and-white, reproduced from the original in the Society's collection (only two original copies of this map are known). 1885.

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GEOGRAPHICAL REVIEW

VOL. X JULY, 1920 NO. 1

CAPE COD AND THE OLD COLONY*

By ALBERT PERRY BRIGHAM
Colgate University

In this essay are offered the results of a regional study of Cape Cod and of the western shore belt of Cape Cod Bay. The region includes Barnstable County, which is practically coextensive with Cape Cod, and the eastern, or coastal, part of Plymouth County. It thus embraces the entire land circuit of the bay. On the east is the open ocean from Provincetown to Monomoy; on the south are Nantucket and Vineyard Sounds; and Buzzards Bay lies on the west from Woods Hole to Buzzards Bay village and Onset.

CAPE COD A NATURAL REGION

We have here essentially a natural region. All but the northern part of the Plymouth County shore belt is of glacial or postglacial origin and has characteristic surface, soil, and vegetation. The shore line, developed on frail Pleistocene materials, matures rapidly and shows a variety of changing features. The climate is distinctly oceanic, and the Cape marks, as nearly as can be designated, the place where the Gulf Stream influences meet the chilling effects of the most southern reach of the Arctic Current.

Viewed in its human relations, the region is as much historically as physically unified. These lands were all settled by the *Mayflower* people or by their early successors in colonial endeavor. They all belong therefore to the Plymouth, or Old, Colony, the two being identical. The region under review does not, however, take in all of the Old Colony, which extended westward beyond the scope of this investigation and on the southwest included the sites of New Bedford and Fall River and some of the lands of eastern Rhode Island.

The industrial oneness of the bay area is in like manner pronounced. It has always possessed a meager agriculture, although the tillage and the

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* This paper, read before the Association of American Geographers at St. Louis, Jan. 1, 1920, is based on more extended studies which have recently appeared under the same title in book form through G. P. Putnam's Sons, New York.

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products have been of a higher order than is commonly supposed. The environmental influences and the resulting activities of the people have ever been prevailingly of the marine order but in greatly variant forms, especially as seen in the summer industry which has grown up during the past forty years.

The Physical Geography of the Region

The unfolding and present status of the human geography form the primary aim of this paper, which might be called an essay in historical geography. The physical basis of Old Colony life will therefore be described in a brief and summary way as affording the foundation and guiding influence of the human activities.[1]

Its Glacial Formation

That glaciers and accompanying agencies have been the main formative forces has been recognized from the earliest observations which came within the field of scientific geology. These were made by Dr. Edward Hitchcock, who, indeed, did not voice such conclusions in the body of his Massachusetts report, but, impelled by the then new studies of Agassiz and Lyell, included in his preface a remarkable diagnosis of Cape Cod as the terminal moraine of a glacier occupying Cape Cod Bay. In more recent years, contributions to the geology and physiography of the Cape have been made by N. S. Shaler, W. M. Davis, and also by J. B. Woodworth, who after many years of investigation has now completed an extended report upon the entire region, including the outer islands, which fall outside the present study.

If we except the postglacial developments of alluvial, lacustrine, eolian, and shore formations, the youngest and most widely diffused deposits are of Wisconsin age. Prior to these, Woodworth distinguishes the following, from younger to older: (1) Vineyard interglacial interval; (2) Manhasset group, represented by pebbly till at Nauset Head and Jacob sands above blue clay at Highland Light; (3) Gardiner clay, at Highland Light ("clay pounds") and a few other localities; (4) Jameco gravel, under the Gardiner clay at Highland Light, old and consolidated; (5) Sankaty fossiliferous moraine sands in deep well near Provincetown and reported in well at Orleans. All of these deposits are considered to be of Pleistocene age, and no boring, well, or shore erosion around the bay has reached bed rocks belonging to older New England terranes. The characteristic thick accumulations and strong topography of the Wisconsin period are found in the Plymouth region, on all of the upper Cape, and even as far down as the town of Orleans and the southern part of Eastham. Beyond that point an older glacial topography appears as far as High Head in Truro. It consists of the low plains of Eastham and of the higher and dissected plains of Wellfleet and Truro, all of which are in places masked by Wisconsin deposits which, however, rarely conceal the pre-Wisconsin expression of form.

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[1] In the paragraphs relating to the physical history, the author acknowledges his indebtedness to Professor J. B. Woodworth of Harvard University.

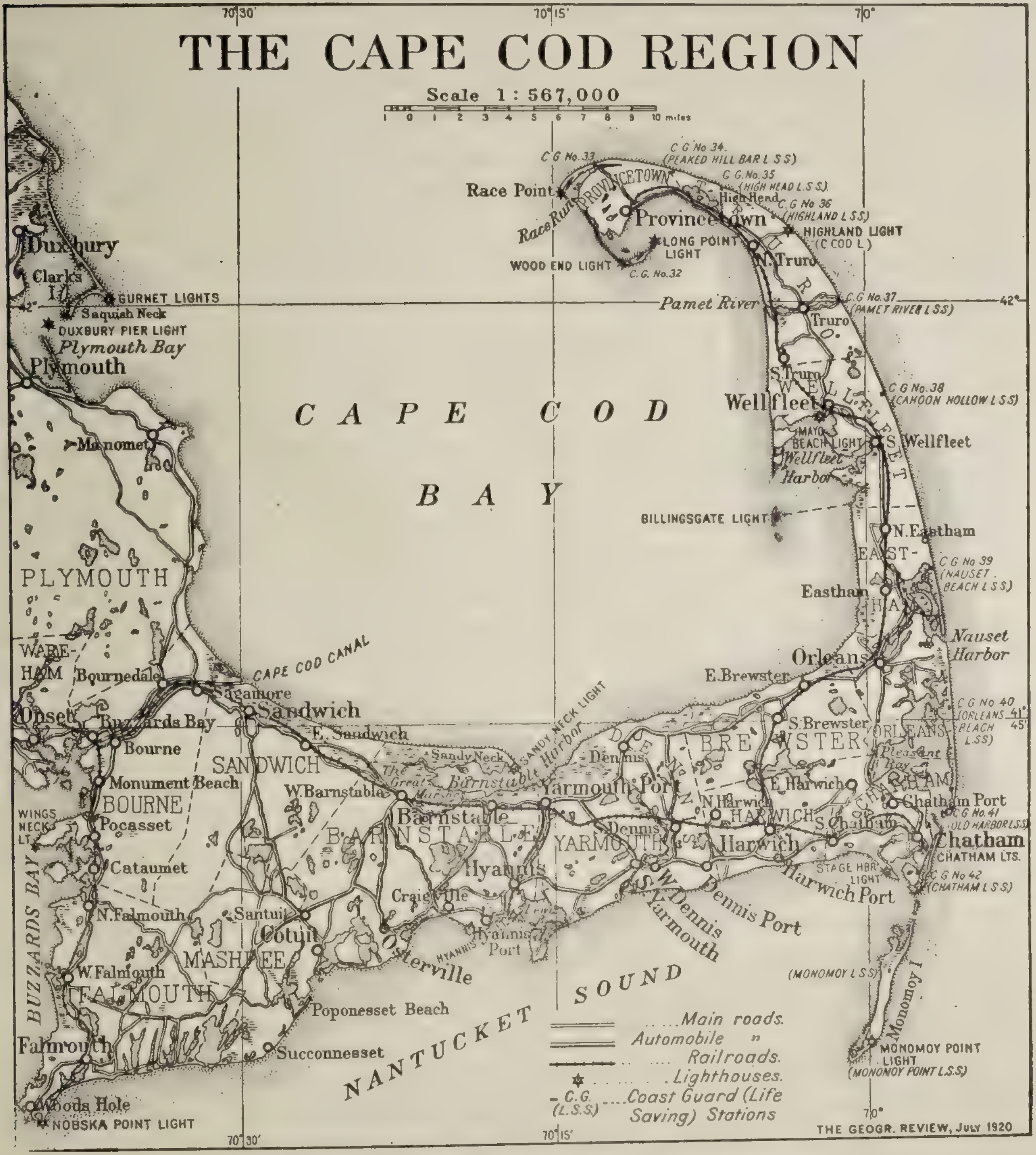

FIG. 1—Sketch map of the Cape Cod region. Scale, 1:567,000.

The Cape is often considered as the most northern extension of the Atlantic Coastal Plain; but, as Fenneman has pointed out, if it consists wholly of glacial deposits built above sea level on a submarine platform, it is not a true coastal plain. Such a glacial peninsula standing out into the ocean sixty to seventy miles from base to tip is, so far as the present writer knows, unique among the shore features of the continents.

THE GLACIAL TOPOGRAPHY AND ITS ORIGIN

Looking more in detail at the glacial topography of the bay circuit, we find a belt of strong, morainic hills extending past Plymouth to Buzzards Bay, Falmouth, and Woods Hole. Branching at the village of Buzzards Bay, or in the town of Bourne at the base of the Cape, a range of glacial hills extends eastward, near the bay shore, through Sandwich, Barnstable, Yarmouth, Dennis, and Brewster, into Orleans and Eastham. These are all Wisconsin moraines, and deposits of similar age are, as already noted, found in patchy distribution northward to High Head.

South of the moraine, which is often unhappily called the "backbone" of the Cape as if there were a rocky axis, is an extensive outwash plain, which descends gently to the borders of Nantucket and Vineyard Sounds. This plain contains many kettle-holes, lakes, and swamps, the last-named forming the basis of the cranberry culture of the Cape. These kettle-holes were due to the presence of stagnant ice left as buried and isolated blocks in the retreat from the Nantucket and Marthas Vineyard ice fronts. Reaching from one to three miles inland from the southern shore is a series of parallel bays, which occupy outwash channels in the frontal apron and are due to submergence and invasion by marine waters. They are identical in origin with the bays indenting the southern shores of the outer islands.

We may therefore picture the Cape Cod glacial lobe as resulting from the recession of the Nantucket lobe to the northern border of the upper, or east-by-west, section of the Cape. There the ice front stood long enough to build a massive moraine, culminating in Bourne Hill at nearly 300 feet. The sands and clays were spread out in front of it, later to be pitted by the disappearance of blocks of the older ice.

At the same time, another ice lobe lay westward. There had been a retreat from the Marthas Vineyard front to the zone of the Elizabeth Islands. The ice deployed west of Plymouth and southward in Buzzards Bay, being therefore properly known as the Buzzards Bay lobe. Hence the Plymouth moraine is interlobate. It culminates in Manomet Hill, at an altitude of 394 feet, one of the most conspicuous landmarks on the Massachusetts coast.

If we go to the eastern shore and look out over the waters, we find reasons for a startling conclusion which Professor Woodworth has drawn from his prolonged studies. Southeast of the Cape are the Nantucket shoals, known for centuries as a menace to navigation. From 100 to 140 miles farther east are St. George's shoals, where tradition has a tale of a ship's crew playing baseball at low tide.

We may now recall what we know of the Maine coast, of the powerful glaciers that moved over it; of their great thickness, dominating and subduing even Mount Desert. We do not know how far a great glacial sheet invaded what is now the Gulf of Maine. To these considerations we add now a striking feature of the topography of the lower Cape in Wellfleet and Truro, namely, a series of about a dozen east-by-west channels which cross it with floors descending to the west. One of the most conspicuous of these is the valley of the Pamet River, so called, which is only a tidal channel extending from the bay to the Atlantic side of the Cape. These valleys were described a hundred years ago by a member of the Humane Society in indicating the positions of rescue huts which might be sought by wrecked mariners. The valleys have every appearance of having been beheaded by the western migration of the shore cliffs.

The valleys must have been made by land streams flowing westward across the lower Cape. Whence came these streams? Let us follow Woodworth in putting the facts together. There was a great lobe moving over Maine to an unknown distance on what is now sea bottom. The St. George's and Nantucket shoals in character and alignment might be the terminal moraine. Waters spilling from the westward margin of the lobe could make the channels that cross the lower Cape. The evidence of the South Channel lobe may not be demonstrative, but it is strong.

We understand therefore that there were three lobes, the smallest, or Buzzards Bay, lobe on the west; the Cape Cod lobe, intermediate in position and size; and the great South Channel lobe. Furthermore, the Buzzards Bay lobe seems to have melted first, and the main drainage of the Cape Cod lobe swept across its moraine and opened the great passage at the base of the Cape which is now followed by the Cape Cod Canal. Then the Cape Cod lobe went out, or waned sufficiently for the drainage of the South Channel lobe to spill across the lower Cape into Cape Cod Bay. Such in brief outline is the origin of the deposits and land forms on and about the Cape.

Shore Line Development

The moraines with their irregularities and the outwash plains with their drainage creases were subjected to a submergence which left the shore line sinuous and broken. The waters intruded among the hills and entered seaward ends of the drainage channels. Such were the conditions when the land took its present stand with relation to sea level. The materials of the Cape and Plymouth shores are frail and easily shifted, and therefore the maturing of the shore lines has proceeded rapidly.

The most violent attack was on the eastern, or outer, coast, where the open Atlantic has been unhindered in its operations. The glacial headlands and promontories were cut away by powerful wave action, and the barriers and spits were brought to their present development. Professor Davis has dealt with the recession of the eastern shore line and with the disposition of the materials thus derived. It is to be remembered—and a glance at the topographic map brings the fact out vividly—that the older, or glacial, part of the Cape ends northward in the town of Truro at High Head, or Pilgrim Heights. Northward and westward are ten square miles of surface redeemed from the sea in the postglacial interval and now occupied by beaches, lagoon swamps and waters, and fields of dunes.

The waste first removed from the outer shore, as shown by Davis, was carried northward and westward and built into a bar on the bordering curve of the harbor of Provincetown. By the common processes of wave and wind work this extension of the Cape became the inner range of dune hills, as related to the present lands in and behind Provincetown. Further recession of the eastern coast cliffs afforded material for a bar outside of the first, thus widening the dune peninsula. Between every two successive bars there was a lagoon, like Race Run of the present time, and, like Race Run, these lagoons filled rapidly, and thus successive accretions were made into continuous land. This process has continued until the dune lands are now three miles wide from Provincetown northward to the open ocean.

The recession of the cliffs of Eastham, Wellfleet, and Truro has perhaps been equal in amount to the outbuilding at the end of the Cape. Hence Professor Davis has well likened the recession of the more southerly line and the pushing out of the northerly shore to the swinging of the land border on a fulcrum, located at or near High Head. The process is not yet complete. A beacon warns the sailor from Peaked Hill Bar, now building outside the northern shore and marking further widening of the new end of the Cape.

The rate of recession of the outer cliffs has often aroused curious inquiry. The government has lost approximately half its lighthouse site at Highland Light during a hundred years or a little more. Professor Woodworth thinks the recession has amounted to a third of a mile in the white man's time, three or four hundred years. There are reasons why the recession may not continue uniformly. It may safely be said, in a general way, that the Cape in that section has been losing width for some thousands of years and that it would require some thousands more to destroy these outer towns.

From the human point of view the most significant result of these changes has been the carriage of the waste under the influence of wind and wave westward and southward from the great bars above described to form the magnificent hooked spit which incloses the harbor of Provincetown.

Not all the material removed from the outer Cape has gone northward. Professor Woodworth indeed thinks that more waste is at present moving southward. The long line of Nauset beaches and dunes springs from the mainland in Eastham, shuts in the shore waters and deep bays of Orleans and Chatham, and terminates at the end of Monomoy about nine miles south of Chatham. Thus the main glacial mass is being cut back, and giant spits and bars are growing north and south, bringing the outer Cape into Gulliver's category of the "winged beheadland."[2]

Similar work is under way on the bay shore, as shown by the cliffs of Wellfleet and Truro. From the western side of High Head near the Provincetown waterworks in Truro there springs a beach which carries the highway and the railway northward. This is a natural barrier save for a short distance near Provincetown, where man finished the work of nature many years ago. The old East Harbor then became a fresh-water lake, with swamps under High Head on both sides. Thus an observer standing on High Head may in imagination see himself flanked by the bars and outgrowing spits, lengthening by the waste brought northward on the ocean side and on the bay side.

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[2] F. P. Gulliver: Shoreline Topography, *Proc. Amer. Acad of Arts and Sci.*, Vol. 34, 1899, pp. 151-258.

Some of the bay materials have gone southward, tying to the mainland in recent decades certain islands which flanked Wellfleet harbor on the west, and the soundings show a broad, slightly submerged bar extending for several miles into the bay southwest from Billingsgate Light.

Among other transformations of the inner shore, two localities have special interest. One of these is Sandy Neck, a dune-capped barrier which nearly incloses Barnstable Bay and the thousands of acres of the Great Marshes.

The other locality is the Plymouth neighborhood. Here some of the waste derived in the cutting of the splendid cliffs of Manomet has been carried northward and made into the beach which incloses Plymouth harbor. Joined to the mainland in Duxbury, the Duxbury beach reaches six miles southward and ties to the mainland the glacial island of Gurnet, where are now the twin Gurnet Lights. In Pilgrim days there were two islands within this beach. One of these, Saquish, has been tied to Gurnet since the *Mayflower* passed into the harbor. The other is Clark's Island, where the scouting party from the *Mayflower* in Provincetown harbor made the first landing and spent the first Sunday on the Plymouth side of the bay. Thus these postglacial beaches shut in the combined shallow waters of Duxbury, Kingston, and Plymouth.

The changes of the southern shore and on Buzzards Bay have been of a minor character, as was appropriate to these more quiet waters. Bars have more or less completely shut off some of the bays, and there are interesting examples of barrier beaches, cuspate forelands, sea cliffs, and tied islands, which make the shores attractive to the summer population and afford interest to the occasional physiographer under whose eyes they may fall.

Wind Work

The main theater of wind activity is on the exposed foreland leading from the outside of High Head around the circuit of Provincetown. Here the dunes have long been observed because their changes threatened the existence of the town and the perpetuity of the harbor. Hence there is a record of about two hundred years of more or less intermittent town, state, and federal activity in restricting pasturage, in preserving the forest cover where present, in the planting of beach grass and pine trees, and in other forms of sand binding. The bibliography contains references to guide the reader who wishes to pursue this line of inquiry in connection with the geography of the Cape. Elsewhere the most conspicuous examples of eolian work are found throughout the reach of Sandy Neck and on the long succession of beaches extending approximately twenty miles from the Nauset Life Saving Station to the southern tip of Monomoy Island.

Though popular impression is to the contrary, there has been little wind work of geological significance in the interior of the Cape. Occasionally the light soils of the glacial terrane have been disturbed and much sand has been swept from beaches and cliff slopes to the top of the coastal escarpments. Popular opinion has been misled here by writers professing to know, who have thought that the entire Cape was an aggregate of sand dunes.

The lagoons, tidal flats, and salt marshes have been important in relation to mollusk and other fisheries and in the cutting of salt hay in older days. They still have potential value, in the aggregate of many square miles which may be reclaimed, as population density becomes great, and become agriculturally productive.

The Human Geography of the Region

When the Pilgrims arrived on Old Colony shores in 1620, the region was not so much a land of mystery as has been supposed. Within twenty years there had been visits and explorations by Gosnold, Pring, De Monts with Champlain, and Captain John Smith, and both the Cape and the first home of the colonists had each received several names, including those which they now bear. For far more than a single generation European fishermen had frequented American waters, and there may have been many unrecorded visits to the Cape and visions of its shores. The conditions were hard enough for the colonists without imagining them as landing in a wilderness wholly unknown.

More than is commonly understood, the Cape, like Plymouth, belongs to the early Pilgrim period. The month of sojourn, of exploration, of deliberation and endurance in Provincetown harbor in late November and early December links the point of the Cape forever with the major settlement on the western side of the bay. Within twenty years also an active diffusion of occupation had reached far out from the Plymouth center. This appears in the migration northward of such foremost *Mayflower* people as William Brewster, Miles Standish, and John Alden and the occupation of lands in the present Duxbury and Kingston, Duxbury gaining its name from the ancestral home of the Standishes in England.

There was a still more extended migration to the south and east, for the oldest town on Cape Cod, the town of Sandwich, was settled in 1637, while Barnstable, the county seat of Barnstable County, celebrated its two hundredth anniversary in 1839. Yarmouth was contemporary with Barnstable in its beginnings and was the parent town of Harwich, Chatham, Dennis, and Brewster. Even Eastham, far out on the Cape and at first known as Nauset, was settled as early as 1647, and there were those who, unmindful of the limitations of the district, were in favor of moving the whole Plymouth colony thither. Truro was settled about 1700, and Wellfleet became a separate town fifty years later. Provincetown was merely a precinct of Truro in 1714 and did not receive separate incorporation until 1727. Thus the colonial movement passed from Plymouth down the Cape and occupied a century in arriving at the first resting-place of the Pilgrims. Then the circuit of the bay was complete, and the southern shore was also occupied by early settlements in Falmouth, Barnstable, and other towns.

Geographic Influences Affecting Early Settlements

It is not difficult to find the geographic reasons for the choice of sites for Old Colony centers of population. The colonists desired a good harbor, for they expected to live in relations with the outer world. This they found behind the Plymouth beach. They found also a strip of land which had long been cleared and cultivated by the aborigines. To have built their homes in the winter, in the face of sickness and death, and to have added to their burdens the clearing of a forest for the next season's planting would have been beyond human power. There were ample supplies of fresh water, and there was timber at hand for houses and for ships. Moreover, Plymouth was in a region almost empty of savages, owing to the sweep of a pestilence some years before; and for enemies that remained, who might rally for attack, there was an isolated hill affording the best facilities for fortification and defense. The soil, for eastern Massachusetts, was good, and there were wild fruits, herbs, and fibers.

Other Old Colony positions offered similar, if less abundant, attractions. Sandwich is in a niche among morainic hills and has a stream for small water power and for the ascent of the herring. Falmouth is on a fertile plain at the eastern base of the moraine, close by fresh lakes and inlets from the sea. Barnstable is on good soil, by the waters of an ample bay, and counted much on the large supplies of salt hay from the Great Marshes. Hyannis is at the head of a branch of the great Lewis Bay and necessarily on the southern-shore highway. Chatham was planted in the midst of a network of protected waters, and Orleans is at the head of Town Cove, a secluded bay which admits the tides to the middle of the Cape. Wellfleet stands at the head of its great harbor, once white with sails and affording upon its wide acreage of shallow bottoms a home for large crops of quahaugs and oysters. Truro is on the tidal inlet of Pamet River, once a good harbor, then destroyed by silting, and now being re-opened by the dredge. North Truro is the old Pond Village, by a small lake in a bowl-shaped hollow, where the dwellers are protected from the fierce winds of the outer Cape. Provincetown, late in origin, has outstripped other towns of the Cape for reasons that are purely oceanic—harborage, fishing, and the romance and scenic beauty of a marine environment.

Agriculture and Fishing the First Occupations

The greater part of the Old Colony was covered at least with isolated settlements by 1692, the year in which the Colony was merged with that of Massachusetts Bay. This is a convenient, if somewhat arbitrary, time marker to set off the period of beginnings. Agriculture was the staple occupation of the colonists from the very outset. They came without even fishhooks or nets for the smaller fish, or apparatus for whales, which played around the *Mayflower* and tantalized the wayfarers with visions of unattainable wealth.

The soils in Plymouth and at other places were pronounced good, even to a spade's depth of true mold in some places. The corn found in Indian caches on the outer Cape was a forecast of the ample crops of this essential grain which would be raised for many years. Twenty, forty, and even fifty bushels per acre were not unusual crops, and the Cape, even the seemingly dreary and barren Nauset, had corn enough and to spare. It was the period of home industry in which all necessities must be met out of the home soil, save as trade should provide funds for getting furniture, clothing stuffs, and other necessities from the mother country. There were no roads or white men to the westward. The Old Colony was not then required to adjust itself to a developing continent that would later stretch out behind it to remote seas.

Though the Pilgrims did not come to fish or to sail, they were forced to do both by their marine environment. Though the Plymouth fathers "sucked the abundance of the seas," they were never very successful in fishing; but they knew the cod, the herring, and the eel, and they did not require large appliances for gathering the shellfish of the Plymouth flats when the tide was out. From the beginning and by geographic pressure more and more as the generations came and went, they became an "amphibious" people.

THE DEVELOPMENT OF WHALING AND THE FISHING INDUSTRY IN THE COLONIAL PERIOD

The seventeenth century led into larger growth, along similar lines, throughout the remainder of the colonial period to 1776, the year of independence. Agriculture of the old type was continued, house industries were universal, and small mills and factories were erected. The grist mill was imperative, and within a few years of the *Mayflower* mills were built at Plymouth and then, to save long and laborious journeys, at Sandwich. Surface streams with suitable fall are so rare on the Cape that wind power was invoked, and the windmill became a common object in the landscape, the few surviving towers being now regarded as among the most characteristic reminders of the older days.

Throughout the colonial period the securing of drift whales engaged the interest of all Old Colony men. To watch for drift whales was a distinct part of public duty in Plymouth, and various towns record regulations to secure private and town rights in such spoils. Readers of Thoreau will recall his diverting comments on the minister who watched the waves for this important addition to his meager salary.

In time boat whaling, for the taking of these creatures in offshore waters, became an important enterprise. An official letter to England in 1688 asserted the great profit of whale killing to the Plymouth colony. The Old Colony was the pioneer in this industry, even Nantucket having followed its leadership and sought its instruction. Down to 1700 Nantucket was the only place outside of the Old Colony that had whaling interests. As early as 1737, Provincetown was sending a dozen whalers to Davis Strait in the far north. At the opening of the Revolution, Wellfleet, Barnstable, and Falmouth had thirty-six whaling vessels, mostly in northern waters.

Whaling and other fishing had reached a large development at the end of the colonial era. The Old Colony then had more than a thousand ships and more than ten thousand men engaged in the work, though Marblehead and Gloucester had taken precedence of all Cape towns. Plymouth and Chatham were the Old Colony centers, Plymouth having sixty vessels and Chatham about half that number. Thus at a time when nearly all Old Colony men were trained sailors, they were ready to take, as they did take, a large part in driving the French power from North America. Equally important was their service in the American navy in the War of the Revolution.

THE FISHING INDUSTRY IN THE FIRST HALF OF THE NINETEENTH CENTURY

This war, however, marked the well-nigh total disappearance of fishing, including whaling, from the New England shores. At the end of the war, the fishing vessels were few, but of widows and sonless mothers there were many in all Cape Cod towns. A picture of the industrial ruin the war brought to the Cape is drawn in the plea of Fisher Ames in 1789, explaining why, if fishing was so decayed and profitless, the men did not leave the region. He said, and it was no uncommon remark in those days, "they are too poor to live there and are too poor to remove."

There was a recovery in fishing after the Revolution, which, although checked in the War of 1812, assumed large proportions in the first fifty years and more of the nineteenth century. Along with fishing grew up in the same period that vast and world-wide extension of sea trade which is one of the glories of New England history.

If we take the first century of the federal period, we may say of Old Colony fishing and marine commerce that they reached their supreme development about 1850 and were far down in decline after the Civil War. By 1800 the Plymouth shore was lined with fishing structures, and the markets were as remote as Spain, Portugal, and the Atlantic islands. At about the same time Provincetown had no less than thirty vessels, carrying their voyages as far as Newfoundland and Labrador. Wellfleet trade was large, and even Duxbury was building ships and catching cod. There was half a century of codfishing in which most Old Colony towns had a part, yet today one may spend a week in any one of them with a good chance of neither seeing nor hearing mention of a codfish.

With the decline in codfish in the middle of the century, the mackerel was taking its place. Wellfleet began her mackerel trade in 1826 and had seventy-five schooners in the business as late as 1860. The facts were similar as regards cod and mackerel in Dennis, Harwich, and Chatham. In the last place, however, nature intervened and by silting the harbor made it impracticable for cod-taking craft, while the smaller mackerel boats could still come and go.

The great decline in fishing in the twenty-five years following 1850 was due to a number of causes. Competition of Great Lakes and Pacific coast products was made possible by railroads and cold cars, and the sardines canned on the Maine coast slackened the demand for mackerel. The introduction of seines in place of lines and hooks put the young boys out of employment, and they began to abandon the Cape. There was enforced idleness in some parts of the year, and the toll of manly life taken in those dangerous seas was so terrible that young women hesitated to marry seamen. Thus the dangers of the business, its change in technique, and the pressure of outside competition reduced the industry to minor importance.

As a natural concomitant of Cape fishing there grew up a widespread salt industry. The Cape shores in the earlier years of the last century were lined with simple plants for the evaporation of sea water. This manufacture culminated soon after 1850. Then western and foreign salt began to contest the market; the lumber for vats, which was Maine pine, became more costly, and the business fell off. There were at one time several hundred plants with an annual output of a third of a million bushels. The last salt plant on the Cape, so far as is known to the writer, was operated in Yarmouth as late as 1885.

Whaling also was at its maximum in the first half of the last century, culminating just after 1840. Falmouth, Plymouth, and Provincetown were all important whaling centers. For most of the towns the last recorded sailings of whalers ranged from 1846 for Barnstable to 1867 for Wellfleet. Provincetown still had three whalers in 1906, and there are today six whalers assessed in Provincetown, but they fit out and land at New Bedford.

Coasting and Oversea Trade

The same period that saw the great expansion of fishing and whaling saw the growth of coasting and oversea trade by those swift sailing vessels that were owned in every port of the Old Colony. At the present time a single steamship plies between Boston and Provincetown, but only in summer time. Plymouth also has a summer boat from Boston. Otherwise the sea is abandoned for the train and the automobile. But conditions were very different from 1800 to the advent of the Old Colony Railroad. There were Cape residents who were at home in the Orient who had never gone to Boston by land. The packets were swift and had regular sailings from ports which today harbor only the minor craft of small fishing or pleasure sailing.

Ships owned in Brewster, Barnstable, Falmouth, indeed in almost all the Cape towns, made voyages to the West Indies, to South America, to the ports of the Indian Ocean, of eastern Asia, and of Australia. Thirty years ago the villages of the Old Colony were full of retired sea captains, who lived in mansions which they or their seagoing ancestors had built. At the present time nearly all who took part in this marine life have passed away, and the mansions in Barnstable, Yarmouth, Brewster, and other villages are occupied by their descendants, either as permanent residents or as summer visitors, or have passed into other hands. The old era of Cape Cod is closed, the time when most of her men were trained to the hazardous life of the sea, were conversant with remote lands and cities, and gained the wide outlook derived from daily experience of the ocean.

The Decline of Agriculture and Fishing After the Civil War

This great decline in the activities of the Old Colony shores took place rapidly after the Civil War. The invention of the steam engine revolutionized seagoing ships. As they became larger and could only move in deeper waters most of the harbors, being shallow, fell into disuse. The railroads brought Western commodities into competition with home products, and there was a great decline in agriculture. This was also due in part to the exhaustion of Cape soils. There are no extensive grasslands on the Cape, and the production of grains is small, thus preventing the keeping of much live stock and limiting the amount of fertilizer which might have served to perpetuate the fertility of the fields. Such exposed towns as Truro and Eastham show at the present time few and small areas of cultivated land as compared with early days.

Fishing has concentrated mainly in the larger centers of Boston and Gloucester, and the mollusk fisheries have in like manner suffered a long decline. Provincetown in Thoreau's day was filled with drying codfish, and scores of ships served the oyster trade of Wellfleet. Proper conservation has not been applied to the preservation and development of the edible mollusks. The fathers thought them inexhaustible and treated them recklessly. The later decades have seen heavy demand and larger production, but this at the expense of almost exterminating these forms of life in some localities. The increasing paucity is shown by the fact that quahaugs are now tonged off some Cape shores at depths of fifty and sixty feet. The fishing sheds and sail makers and boat repairers are few in all Old Colony villages, and the ancient docks are falling to decay.

Decline in Population

With the breaking up of marine business the main motive for living on this foreland has been impaired, and many of the more progressive and ambitious people have migrated to Western homes and larger opportunities. There has been a decline in the population of many Cape towns and of the Cape as a whole. The town of Truro is a typical example, having lost its marine life and not having gained as yet such compensations from summer trade as have come to a number of the other Old Colony communities. In

1800 Truro had about 1,150 persons. It moved steadily with the general marine growth and had in 1850 a population of 2,100. Then began a steady and unbroken decline until 1910, whose census record showed a population of less than 700. Provincetown, on the other hand, having 200 persons at the opening of the American Revolution, did not cease to grow until 1890, when the population was about 4,600. Then there was decline until 1900 and some recovery to 1910.

The whole of Barnstable County had 12,000 inhabitants in 1765 and grew in numbers in every decade until 1860, when it had 36,000; after that date it fell more or less rapidly until 1910, when the total was between 27,000 and 28,000.

Modern Adjustment to the Life of the Summer Resident

It remains to observe the changes that have come in the life of the Old Colony region during the last half century, or since 1870. The fundamental condition, as in all the earlier history, has been the marine environment, but the reaction to it has been in the main of a new order. A dense and wealthy population has occupied the New England interior, the Middle Atlantic States, and the Mississippi Valley. The common needs of the coastal region are now met not by home industry but by purchase. A hotel in Chatham or Wellfleet may order even its fish and its lobsters from Boston. Cape Cod no longer derives the major part of its income directly from the sea.

The region belongs, however, to the ocean as much as ever it did. It does not draw out its living with hook and seine or get valuable booty with a harpoon; but it has resources in wave and surf, in cool and salty winds, in cliff, dune, field, and moor, in lake and forest, in expansive views, in historic lore and patriotic ideals. It is the home of the fathers, a land of the imagination, a place for rebuilding shattered energies. These resources have become tangible; they are transformed into money; and, reluctant as the elder men may be to admit the change, the leading industry of the Cape is not fishing nor cranberry growing but the summer resident. The Old Colony in its three centuries of geographic unfolding has reached its place of adjustment in reference to the continent behind it. To fish, to catch whales, to raise corn—these were temporary conditions, leading up to uses to which the land is most suited and in which it may fill its largest place in the greater domain of which it is a fragment.

Localization and Specialization of Industries

This change does not mean that the old occupations are dead. There will always be fishing and sailing, farms and crops; but these will be limited, localized, and special. There are, in place of stacks of drying fish, several refrigerator plants in Provincetown, and there is one each in Truro, Yarmouth Port, Barnstable, and Chatham. There are fish weirs at Provincetown and Truro and off the southern shores of the bay; there are lobster traps; and the oyster, the clam, the quahaug, and the scallop are still harvested. These industries, however, are only fringes on the edge of a larger life. There are more automobiles than there are bushels of oysters in a Wellfleet season, and there are more artists than there are codfish in Provincetown. One can chaffer with a stray fisherman off the dock at Plymouth, but Plymouth is mainly at home in her Pilgrim memories and in her great factories. We may not agree in interpretation of the facts, but we recognize the great change expressed in the utterance of the now elderly daughter of an old sea king of Truro, "The Cape ain't what it used to be, its runnin' down fast."

The writer has seen cornfields on the upper Cape which would look well in Illinois or in Iowa, but corn is no longer a staple crop in that region. Around Barnstable and in some other towns are good meadows and pastures, replacing the salt hay that was formerly much esteemed. Today, however, the piles in the marshes are going to decay, without supporting the picturesque stacks of the old time. Yet "English" hay will never be extensively grown on the light Cape soils.

There is a notable revival of agriculture, but it takes special forms adapted to soils, climate, and the markets. The main specialties are apples and small fruits, vegetables and poultry. Dairying is and must be small and local because this industry cannot carry the heavy cost of Western feed and the pastures are inadequate. Apples thrive under modern care, and there are model orchards of fine fruit even as far down as Truro, where protected situations are utilized and scientific care is given.

The Cranberry Industry

The great development in small fruit is in the cranberry, in which Barnstable and Plymouth Counties lead all other parts of the United States. The culture was developed on the Cape less than a hundred years ago, and all Massachusetts cranberries are often named as of Cape Cod, though Plymouth County produces more than the Cape. Like most other crops, the cranberry has seen much modern improvement in care and in harvesting, and plantations are larger or consist of many fields under one management. A single company operating in Plymouth County controls about 800 acres of bogs.

All the natural conditions needed by this fruit are perfectly supplied in this region. The natural marshes, due to glacial blockade and the filling of shallow lakes, afford the chief requisite. The water needed for flooding is at hand, by gravity flow or by pumping, and there are ample and convenient beds of sand for sanding the bogs. In addition, the growing season is long, and the severe frosts of autumn are usually subsequent to the period of harvest. The cranberry is a nearly perfect adjustment to nature in the lands of the Old Colony.

Other Fruits and Vegetables

The fruit next in importance, but a remote second, is the strawberry whose development was much later here than the culture of the cranberry The main center is the town of Falmouth, and the cultivators are the somewhat recent Portuguese immigrants. These newcomers have bought old farms and have cleared many fields in the oak scrub north of the main highway, where strawberries are supplemented by red raspberries and several kinds of vegetables, with some corn and beans. The markets for the berries are found locally and in Boston, seventy-three carloads of strawberries having been shipped from the Falmouth village station during the season of 1919.

One vegetable, asparagus, is assuming commercial importance as a characteristic Cape product. The principal development is in the town of Eastham, where some large and many small fields are found, and it is extending into other parts of the Cape. There is no reason why asparagus and strawberries should not be grown in nearly all parts of Barnstable County. The cranberry does not move eastward much beyond Orleans on the outer arm of the Cape.

Several nurseries have been established, including one forest nursery of the state of Massachusetts. Work was begun on this nursery in the outskirts of Barnstable village as late as 1913, and already the nursery has 4,000,000 trees in various stages of growth, including 2,000,000 white pines which will be ready to transplant in 1920. There is much reason in climate and soil for future progress here in the nursery industry.

Large-Scale Farming

Some attempts have been made at farming on a large scale, with modern machinery and the use of all advanced methods. It has been shown that there are areas of productive soil, and good results have been gained. It has not been shown that such farms could ever meet the large overhead charges which could be afforded by men of wealth. Thus there is a ranch of 14,000 acres near Hatchville, the lands being part of the outwash plain in Falmouth and Sandwich. Tractors are used for clearing, modern buildings have been erected, blooded herds established, large fields of corn and other forage crops put in, and an asparagus plantation started.

In like manner the smaller Lombard ranch at Forestdale, in Sandwich, demonstrated the existence of eighteen inches of good soil. Luxuriant crops were raised where but two years before there was oak scrub. Such work requires free use of capital. Small undertakings demand the owners' hard labor and are therefore confined to Portuguese and Finns who, with their large families, are accustomed to toil and win success in fields which the native Americans do not attempt.

MANUFACTURING

The environment of Cape Cod Bay has never given itself largely to manufactures. Water powers are few and small, and such industry therefore lacked the early impetus which it received in many other parts of New England. Grist mills and small woolen mills met the needs of the local people, but in the main these have disappeared. Salt was made, as we have seen, on a scale large for the times; but that industry, too, has completely passed away. At one time the largest glass factory in America was operated at Sandwich, but that was long ago abandoned, and the buildings are beginning to fall into ruin.

Such important manufacturing centers as Brockton, Fall River, and New Bedford had grown up in the Old Colony, but these lie outside the field of this essay. The two exceptions to the general rule in the bay county are Plymouth and Sagamore. At Plymouth are immense cordage works, which bring their raw material from Yucatan in their own ships and land it on Plymouth docks. The town also has large textile and metal works; but they have not seriously invaded the historic center of Plymouth, and they do not injure the Pilgrim atmosphere or make the town any the less an alluring place of pilgrimage.

Sagamore, in the town of Bourne, long a part of Sandwich, the oldest Cape town, offers a discouraging introduction at the gateway to those who visit the Cape expecting only rural simplicity and the solitudes of the sea. The great car shops do not seem in keeping with the marine border. But they are soon left behind with the barren wastes of the canal dumping, and the forests, marshes, sand dunes, and water vistas of the real Cape Cod begin. We may say of the factory, as of fishing and farming in the Old Colony, that it has become specialized and localized. None of the three longer stands for the main motive or leading occupation of the Cape or its Plymouth background.

RAILROADS AND HIGHWAYS

As in every modernized region, the processes of invention, applied to transportation, have gone far to revolutionize the geography. The railways approaching Plymouth from the north and west find their terminus there. These roads run from Boston by way of Hingham and Duxbury, from Boston by way of Whitman, and from Middleboro, which is the Old Colony outlet to New York City and the South. Curiously, no steam or electric road leads along the shore to the Cape, over the first long trail which the Pilgrims most used. There is, however, a state road through the coastal forests from Plymouth to Sagamore and Buzzards Bay.

The main highways of the older Cape were, as we have seen, on the water. Steam enlarged the ships, drove out the packets, and brought in the railway, which made water transportation unnecessary for reaching inland places or the northern shore. At the same time the advent of the

Old Colony Railroad removed the stages from the heavy sand roads of the Cape. The railway was opened from Middleboro to Sandwich in 1848, to Hyannis in 1854, to Wellfleet in 1869, and to Provincetown in 1873. The Chatham branch was finished in 1887. Woods Hole had been joined to Buzzards Bay and the main line in 1872, the year in which the various branches became known as the Old Colony Railroad. The conductor who ran the first railway train into Provincetown still lives in Orleans.

The state roads, which are now perhaps the most marked feature of the whole region, save the bordering sea, followed upon the invention of the automobile. There is a trunk line near the northern shore and another near the southern shore of the upper Cape. These lie far enough back from the main water to pass around the heads of the numerous bays and salt marshes. Some parts of these lines are almost a continuous village, as from Barnstable to Brewster and from Hyannis to Chatham.

Connecting roads have been built through the forests from one main line to the other across the Cape. One joins Woods Hole and Buzzards Bay along the Buzzards Bay shore; another leads northward from Chatham and, uniting with the north shore line at Orleans, becomes the trunk road of the outer Cape, ending at the Pilgrim landing place in Provincetown. Spurs of improved road lead out to the open sea in Orleans, from North Truro to Highland Light, and in Provincetown.

The Cape is not now so much engaged in sailing ships as in helping other people to sail them. Marine maps show hundreds of wrecks off these fateful shores. The Humane Society's huts were in due time succeeded by a chain of fully equipped life-saving stations, stretching from Race Point to the southern end of Monomoy. Cape Cod light, commonly known as Highland Light, is the most powerful on the New England coast and is supported by other beacons and light ships at danger points of the inner and outer shores.

The Cape Cod Canal

We may now recall the remarkable scourway opened at the base of the Cape by the waters from the glacier of Cape Cod Bay. Tidal waters entered it from the north and south, and from either side the lofty hills of the moraine look at each other across the gap. Plymouth colony was barely two years old when Governor Bradford visited Manomet River and saw the facility with which trade could be carried on between the two great bays. Like all great canals, as Suez or Panama, possibilities were seen long before they were realized, thousands of years for Suez, hundreds for Panama, and generations for Cape Cod. Washington was interested in the Cape Cod project, and a survey was made by a Cambridge engineer in 1791.

Not until recent years was the canal completed, but it has already become one of the important waterways of the Atlantic coast and a part of that great system of protected channels by which communication will, in the near future, be established between our Northern and Southern shores. Already the New York and Boston boats use the inside route, and the tows of coal barges are less often seen from the eastern cliffs, pursuing the old and dangerous route of the stormy Atlantic and the treacherous Nantucket shoals. The saving of distance is from 63 to 152 miles for ships moving from any ports between New York and Providence to ports north of the Cape. The New York and Boston boats shorten their running time from sixteen or eighteen hours to thirteen and one-half hours. Government ownership and release from tolls would invite all, or nearly all, shipping along the coast to the safe inside route.

Evidences of Prosperity Due to the Summer Life

The summer industry has become the dominant interest of the Cape. This may not be capable of proof in figures, but of its truth the author, after some years of observation, has no doubt. Indeed, only one resident of the Cape—and inquiry has been made of many—has expressed a contrary opinion. In this instance there was, it would seem, reluctance on the part of an old and honored citizen to concede that the old life of the Cape has been so largely replaced by a new order.

There is not much winter activity, but the summer life expands in every town; in a few, whether one likes it or not, there are displays of an almost metropolitan activity. The financial returns of this industry come in by numerous and often untraceable channels. The hotels and boarding houses, the provision stores and garages could count their annual receipts and profits. We are, however, to take account of the stated and year-round outlays upon summer homes, the vast increase in taxation values, the outlay for roads, and many other things in which the Cape exchanges the boon of nature for the support of its life.

The new growth may be marked in the increase of summer train service and more recently in the vast movements on the state roads. A single day's census in the village of Hyannis during the summer of 1919 showed that 9,000 automobiles within the day passed a given point on the main street of the town.

The town of Falmouth in 1872 had taxation values of less than $2,000,000. The next quarter century almost quadrupled the valuation of the town, and another twenty-five years brought the figure to $20,000,000. This sum does not now appear on the tax roll owing to recent changes in the order of state and federal taxes. There is no possible source for most of this increase, other than the expansion of the summer life. Chatham about quadrupled its valuation from 1890 to 1919, and the facts are similar for some other towns. There is no apparent limit to the enlargement of summer business which may take place in the future.

Changes in the Character of the Population

The circuit of the bay has in three hundred years seen interesting changes of population. The changes in totals have already been noticed. It remains to refer to modifications of the primitive stock. The whole region is sparsely peopled, because the soil resources are small, because it is not suited to the growth of cities, and by reason of the migration westward of the sons of the Old Colony. Barnstable County's density at the census of 1910 was 67.8 to the square mile as against 418.8 for the entire state. Plymouth County had a density of 213.8. If, however, we leave out the city of Brockton and other industrial centers of the interior, we should find that the shore areas are much like the Cape.

Barnstable County had in 1910 a little over 13 per cent of foreign-born inhabitants, a figure so low as to be in striking contrast with Boston or any other large city of the state. Plymouth County had only about 20 per cent of foreign born, although it contains the large manufacturing city of Brockton. The foreign born consist more of Portuguese than of any other nationality. They have come from the Atlantic islands and from Portugal and represent both white and black Portuguese. The older incursion of this nationality is in Provincetown, where the Portuguese probably constitute nearly half of the permanent residents. They have spread southward into Truro. The recent Portuguese incoming has been in Falmouth, where they number perhaps 1,000, and they have spread eastward through Barnstable as far as Harwich and Chatham. They are fishermen to a considerable extent on the lower Cape but are given to the soil on the upper Cape.

The Finns have long formed a small colony in Barnstable, and the Italians center in Sagamore and Sandwich, many of them being employed in the Keith Car Works. There are some recent comers from England and other parts of Great Britain, which fact if taken into account would reduce the percentage of the foreign born who are in any sense alien to the primitive colonial stock. Altogether we may say, and it is one of the alluring features of these shores, that here we still have one of the most American parts of America.

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THE SAN BLAS INDIANS OF PANAMA

By S. P. VERNER

The San Blas Indians of Panama are well known by popular repute. Every visitor to the Canal Zone hears of their peculiarities, yet scientific knowledge of this tribe, so interesting in itself and in the circumstances of its survival, is exceedingly limited. The present "San Blas country" lies in the province of Colon, east of the city of Colon, and includes the islands off the Caribbean coast between Colon and Colombia, beginning about 40 miles east of the Canal and extending for about 70 miles towards the Colombian border. Occupying a territory in which the white settlement is the oldest in America, these Indians have nevertheless resisted subjugation for four hundred years and, except for a few minor modifications produced by their occasional contact with civilization, are practically what they were when Columbus first saw them.

Small Stature

The most striking physical characteristic of these Indians is their smallness of stature, with their very marked Mongolian features as a close second. They probably do not average five feet in height, while full-grown men several inches shorter are quite common. Their bodies are long in proportion to their legs; their chests are usually finely developed. They are splendid tree climbers and expert swimmers, while their skill with the canoe is marvelous. They will successfully negotiate the voyage from their islands to Colon in fifteen-foot dugout canoes in waters as bad as any in America, where the white men hesitate to go in launches or larger craft.

Mode of Life

The San Blas islanders live in palm-thatched houses of sticks and palm-fronds, some of the islands being practically covered with their dwellings,[1] placed so close together as to look like one immense building covering an acre or more of ground. It is probable that the Indians deserted the mainland for residential purposes to escape the mosquitoes which infest the marshes along shore but which are notably absent from the cays. They live mainly by hunting, fishing, and petty agriculture. The principal crops are corn, plantains, cassava, and rice, while they possess fine plantations of coconut palms and ivory-nut palms, which form their chief sources of wealth.[2] They go to the mainland daily to cultivate their farms, to get wood and water, to hunt, and, it has been stoutly maintained for years, to work their secret gold mines. The San Blas either have inherited considerable gold from their ancestors or they have a way of obtaining the precious metal still, for the women wear gold ornaments and many of the men own quantities of gold which they will not part with.

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[1] Frederick Collins: The Isthmus of Darien and the Valley of the Atrato Considered with Reference to the Practicability of an Interoceanic Ship-Canal, *Journ. Amer. Geogr. Soc.*, Vol. 5, 1874, pp. 138–165; ref. on p. 141.

[2] Henri Pittier: Little Known Parts of Panama, *Natl. Geogr. Mag.*, Vol. 23, 1912, pp. 627–652; ref. on pp. 650–651.

Aloofness

There are many local legends concerning the inhospitable attitude of these Indians towards whites attempting to penetrate the interior back of their islands. It is said that they have an iron-clad rule that no stranger shall remain in their territory after sundown, and authentic cases where they turned back would-be explorers have occurred frequently enough to justify the statement, while some white men who tried the trip were never heard from again. It is true that less is known of the mountainous region between the head of the Chagres River and the Colombian frontier, on the Atlantic side, than of any other part of Panama. During the reconnaissance surveys for a ship canal in the early seventies, Selfridge's party penetrated the interior back of the Gulf of San Blas but met with no opposition from the Indians.[3] Dr. Henri Pittier, the noted botanist, likewise got into part of the interior, with a San Blas boy as a cicerone, and was inclined to scout the theory of inadmissibility.[4] However, he was an exceptional explorer of long experience and fine diplomatic power. This exclusion of strangers by the San Blas is due to a primitive distrust of the alien, coupled with a recollection of their wrongs at the hands of the Spaniards, as well as to their independence and their pride in the purity of their race.

Clothing and Housing

The San Blas are beginning, however, to show many modifications in their aboriginal customs produced by contact with the whites. This is seen chiefly in their dress, which now often consists of cotton cloth of English manufacture, while the men, especially when visiting Colon or Panama, go clad in complete suits of clothes. The women still wear the short skirt and colored chemise, appliquéd in curious designs, which was their costume two hundred years ago.[5] Most of the women wear gold nose-rings, and they adorn themselves with many necklaces of beads and metal coins. Their needlework is exceedingly skillful, and they make a kind of tapestry. They are also fond of making figured cloth out of cotton fabrics bought from the traders; and they buy different colored cloths, dyeing them with their own pigments. They design ornamental pieces very skillfully, much of their work having been shipped to Germany before the war.

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[3] Collins, *op. cit.*, p. 140. See also footnote 12, below.

[4] Pittier, *op. cit.*, pp. 646–647.

[5] Eleanor Yorke Bell: The Republic of Panama and Its People, with Special Reference to the Indians, *Ann Repl. Smithsonian Institution*, 1909, pp. 607–637; reference on p. 630.

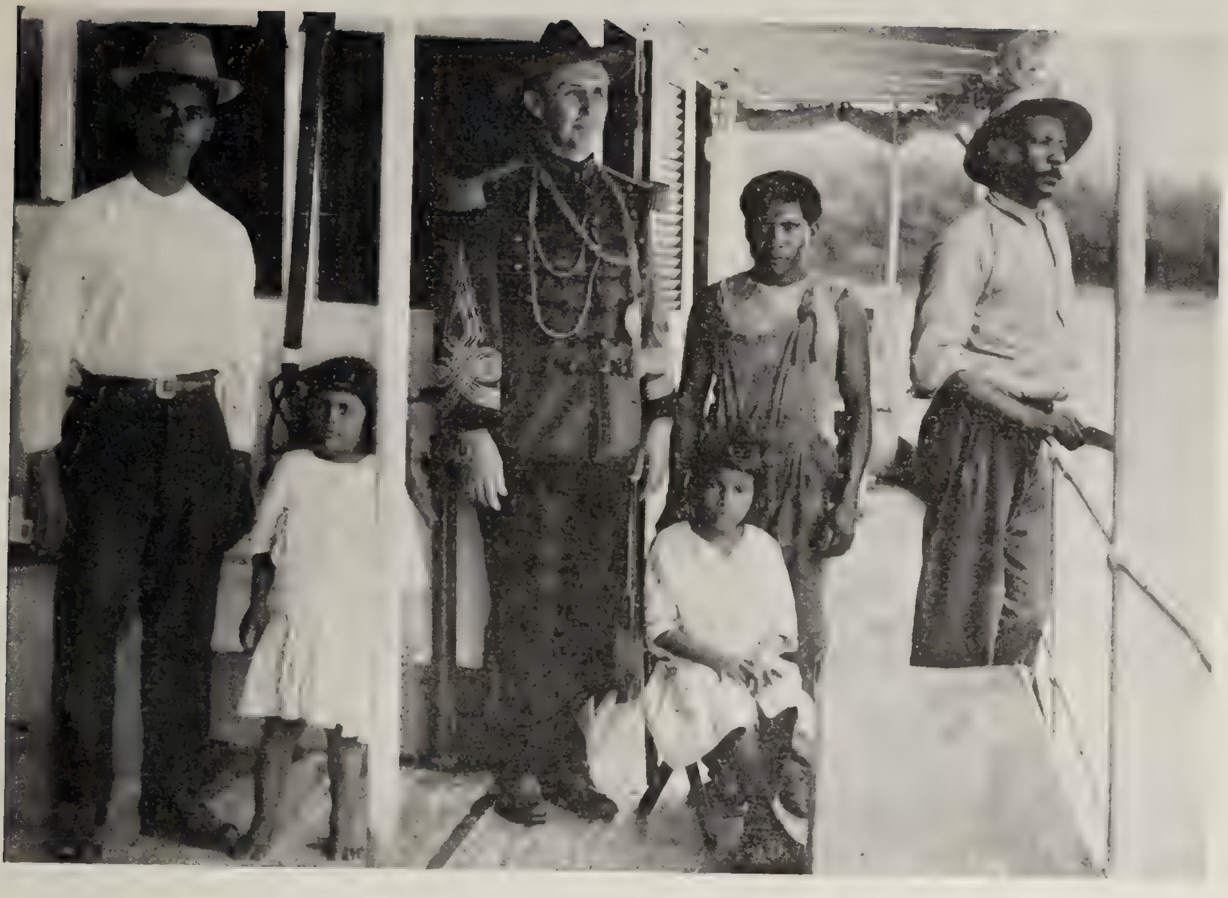

FIG. 1.

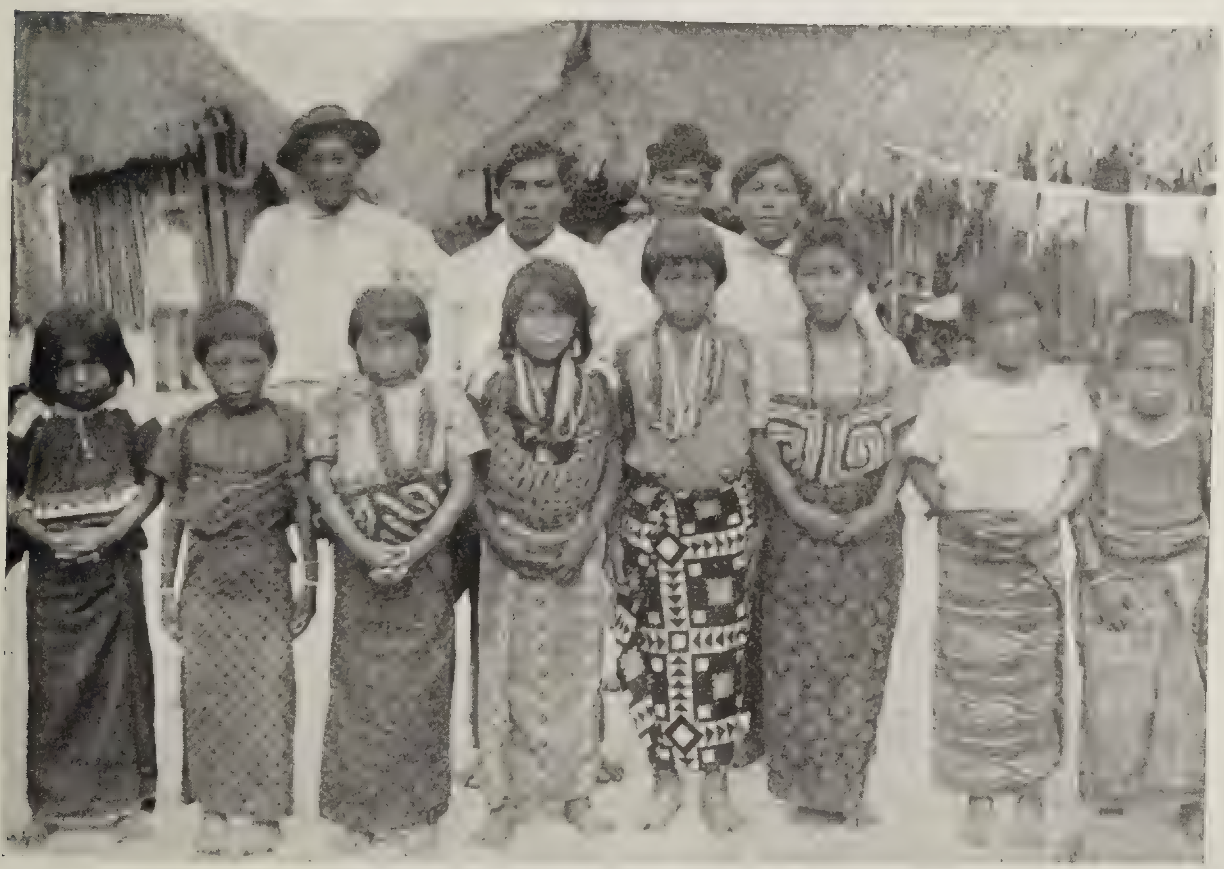

FIG. 2.

FIG. 1. A San Blas Indian (second from the right). The shortness of stature is evident from a comparison with the West Indian negroes and the American in the group.

FIG. 2. A group of San Blas Indians. (All photos by Dr. George Curney, the official physician of the Panama Government in charge of the first dispensary and hospital in the San Blas country.)

The houses of the San Blas are large and skillfully constructed with a thatched gable roof, supported by columns of bamboo or palm-tree posts. The interior is divided into compartments by upright posts.[6] They have recently begun to build houses of planks, and some of the wealthier Indians are ambitious in this respect.

Number

Estimates differ as to the numbers of the San Blas Indians. As high a figure as 50,000 is given by J. Dyneley Prince.[7] Others place it at 8000 to 10,000.[8] Certain it is that today they are increasing rapidly. Their growth is particularly interesting in view of the decimation that had gone on between the time of their discovery and the treaty with Spain, by which the Spaniards abandoned all their forts in San Blas territory.

Relation to Present Government

The San Blas are shrewd, energetic, and healthy, and will soon become well civilized under the new régime in Panama if a benevolent policy is consistently and intelligently pursued. They are loosely organized under a chieftain, with several sub-chiefs, and there have recently appeared a number of rival aspirants for recognition as their representatives before the Panama government since the latter has attempted to incorporate them into its organized citizenship. Most of them steadfastly refused to acknowledge the sovereignty of Panama after the secession in 1903 and persisted in regarding themselves as Colombians. This fact was somewhat humorously ignored, and only in the last four years have diplomatic efforts been specially directed toward getting them into the Panama fold, a step inaugurated largely by President Porras and the American Minister, Mr. Price. Their indifference to the new régime which had started near their doors is illustrated by their refusal to allow the Canal authorities to get sand at one of the settlements, the chief of the village replying to the Canal Commission's request that if God had meant the Americans to have that sand, He would have put it at Colon. Miss Coop, an American missionary, went to live among them several years ago and has made considerable progress in elementary education with her pupils. In 1915 the Panama Government established a custom house on one of the islands of the San Blas, where all trading boats must clear.[9] The Republic now has a resident official in their capital, with a physician and a staff, and is beginning to promote the assimilation of the tribe.

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[6] Pittier, *op. cit.*, p. 657.

[7] J. Dyneley Prince: Prolegomena to the Study of the San Blas Language of Panamá, *Amer. Anthropologist*, Vol. 14, 1912, pp. 109–126; reference on p. 109.

[8] Bell, *op. cit.*, p. 626.

[9] J. G. Steese: San Blas Indians Leaving Their Isolation, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, p. 773.

ORIGIN

It is difficult to get much light on the origin of the San Blas, since their culture is primitive and the four centuries of stubborn resistance to foreign invaders have left little of tradition available to the present generation. The early Spanish historians have described the Indians of Darien—as the whole of the eastern Isthmus was known—under a great number of tribal names, while the designation Cueva was applied in a comprehensive sense.[10] By many authorities the Darien Indians of the Caribbean coast are believed to belong to the Cuna family, which is of Carib origin,[11] though the San Blas themselves disclaim racial connection with any other tribe.

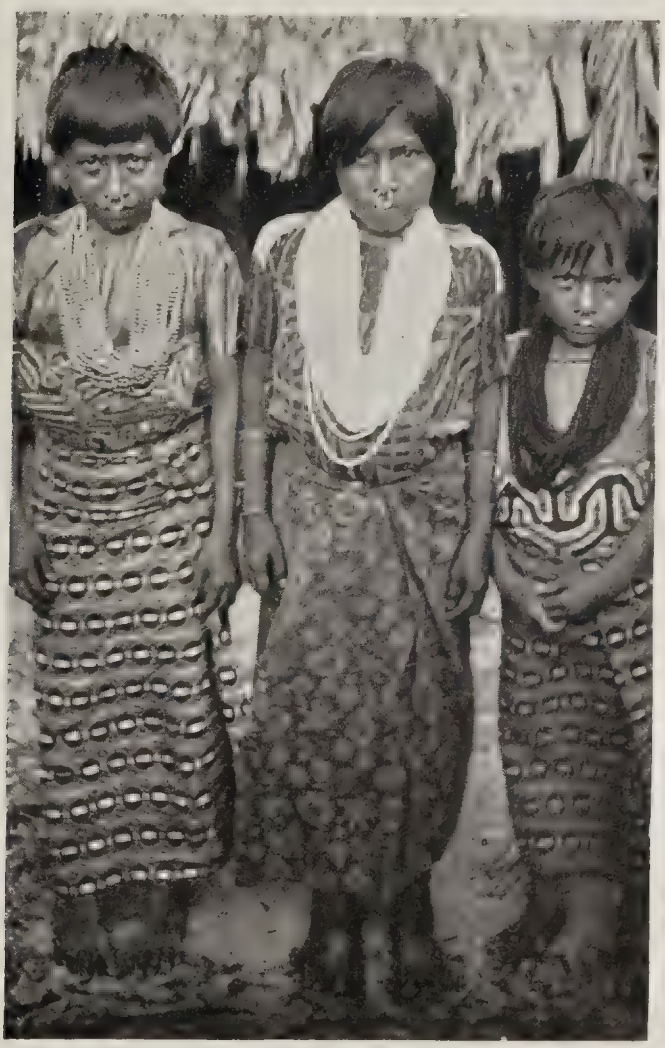

FIG. 3—San Blas Indian girls on dress parade.

The San Blas say that they are not original shore-dwellers but mountaineers and that their ancestry once lived in the interior. Early writers intimate that there was a marked difference between these two types—the mountain residents being much wilder, more intractable and hostile than the occupants of the littoral and less given to the arts of agriculture and such semi-civilized pursuits.' Even today the dwellers in the San Blas hinterland are as primitive as any in America. They dwell in small settlements and live by the chase, trading meat and forest produce with the sea-island Indians. Little is known of the facts of distribution in the interior. Selfridge[12] found the country back of the Gulf of San Blas uninhabited, but further east he believes the settlements of mountain Indians to be more numerous than generally supposed.

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[10] See Oviedo's "Historia General y Natural de las Indias", Book 29, Chapter 26 (Vol. 3, p. 125, of 4-vol. edition of Real Academia de la Historia, Madrid, 1851-55).

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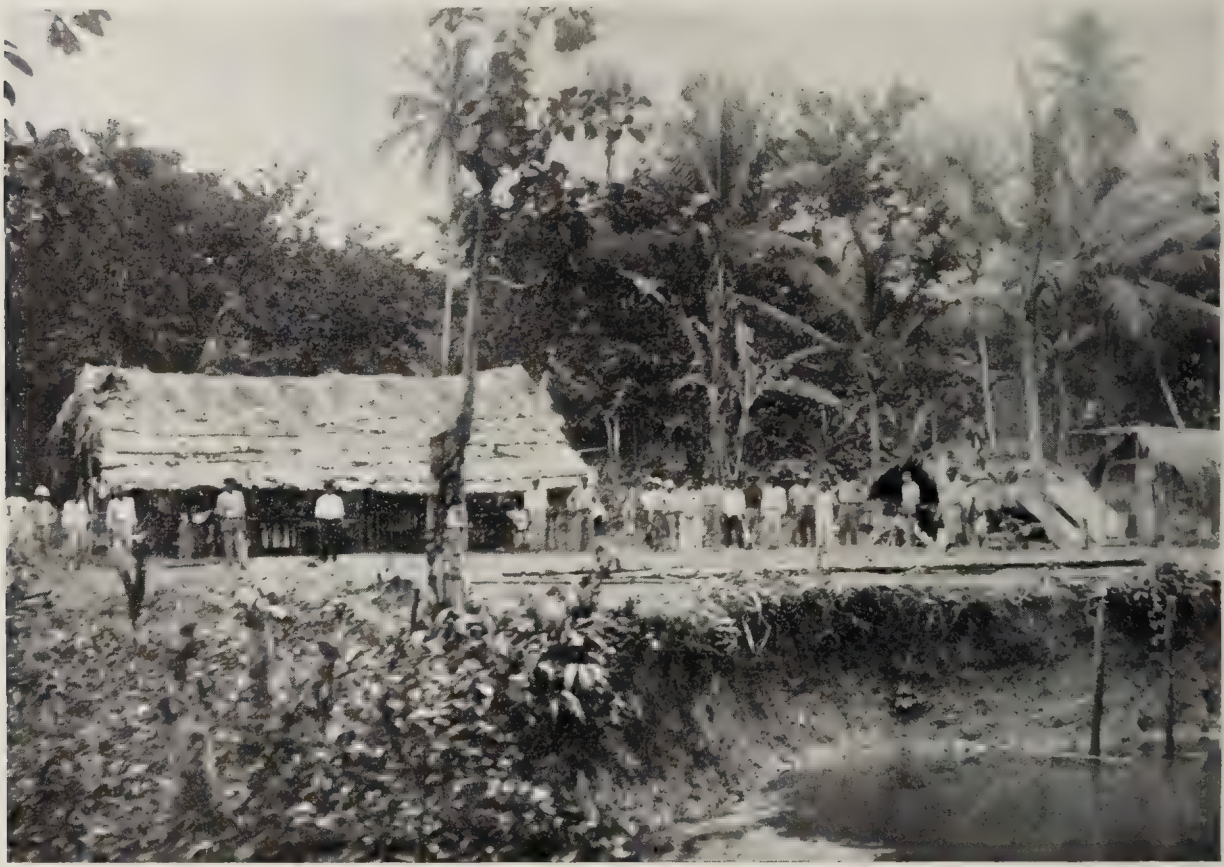

FIG. 4—A San Blas settlement on one of the coast rivers.

STATUS AT TIME OF DISCOVERY

The territory now occupied by the San Blas was densely populated in Columbus' day and until they were decimated by war, slavery, rum, and the diseases brought in by the whites. This is abundantly attested by early explorers and writers, as well as by the fact that the forests on the littoral of the Atlantic in that locality are not primeval but show that the land was once well cleared. The tribes constituting that population were not hostile to the first whites, and in the San Blas region Columbus was well received at the point named by him Puerto Bello. Before the coming of the

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[12] Report of Explorations and Surveys for a Ship Canal, Isthmus of Darien, Navy Dept., Washington, D. C., 1874, p. 10.

Spaniards the Indians had developed primitive agriculture to a considerable degree, a fact of great service to the early conquerors. They prized gold and knew how to wash it from the sand of the little rivers in that region.[13] They were probably ignorant of the art of mining gold but doubtless learned this from the *conquistadores.* They were expert hunters, trappers, and fishermen, using the bow, nets, and primitive trapping devices, and they possessed canoes. There is little evidence of any religious cult among them and they had no great temples such as were erected by the great races to the north and south. They were organized into the usual tribal forms, with kings (*caciques*), and they recognized the tribal laws.

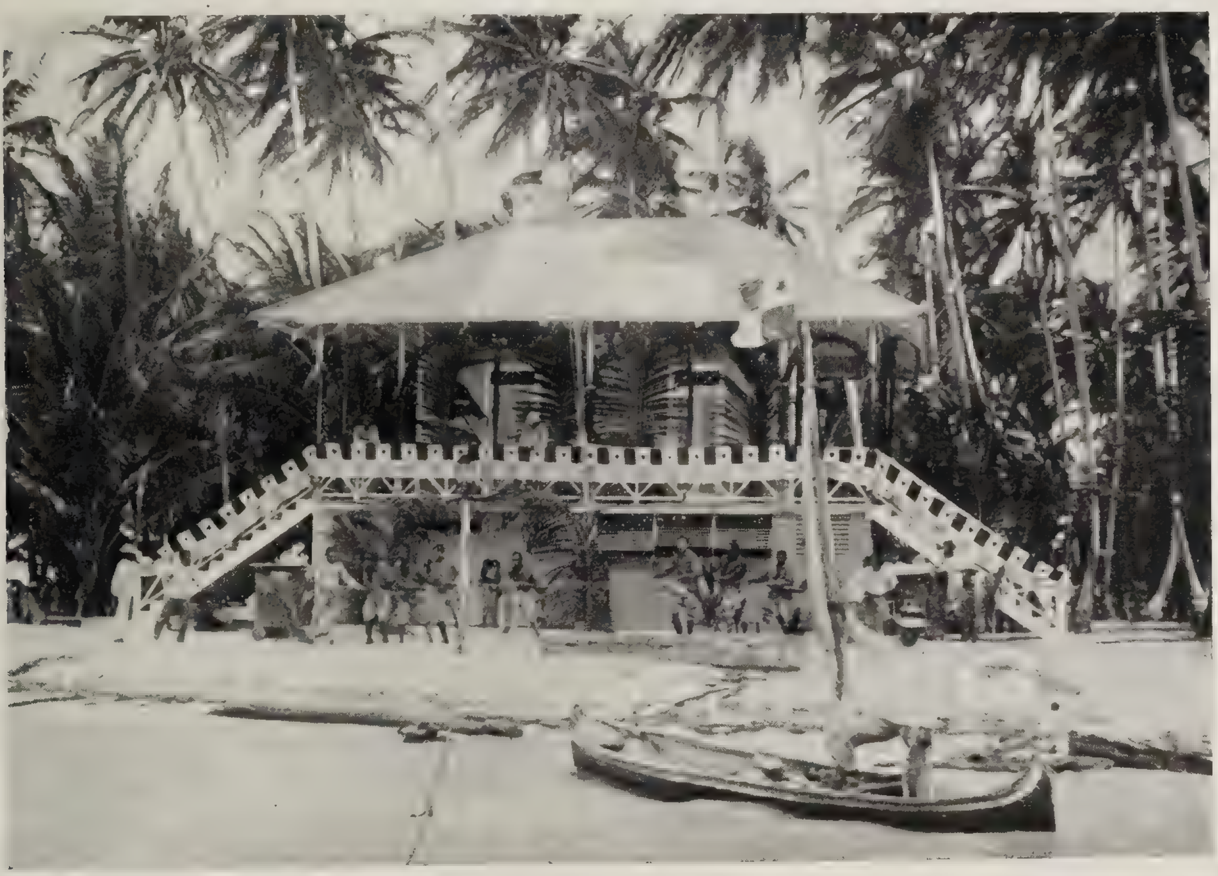

Fig. 5—A house showing modern influence at work among the San Blas Indians.

Uninfluenced by Higher Civilizations to North and South

The early Cuna Indians knew something about the Peruvians, for they stimulated the curiosity of Balboa and of Pizarro by what they said about the gold and the might of the people on the Pacific,[14] but they were not strong enough to react to such curiosity themselves. The Inca civilization was a wonder-rumor to them. They were as little affected by the culture of their cousins four hundred years ago as they were by the whites who brought the wonders of the world to their doors. They had neither the governments, arts, nor the force possessed by the wonderful peoples who made Mexico and Peru splendid before the discovery of America. There are no monumental remains in or near their territory.

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[13] Lionel Wafer: A New Voyage and Description of the Isthmus of America, James Kempton, London, 1699, p. 31.

[14] Peter Martyr: De Orbe Novo, translated from the Latin by Francis August MacNutt, New York, 1912, Vol. 1, pp. 220–223.

POSSIBLE PYGMY RACE

How and why it happened that these great cultures of the north and of the south were so widely separated, with no intermediate cultural development on the Isthmus of Panama other than the primitive sort presented by the San Blas and similar tribes, constitutes an interesting and somewhat puzzling problem in American archeology. Are the San Blas the remnants of a primitive migration into America of a people less developed than those others, or are they a case of stagnation under the handicaps of their environment? The physical characteristics of the Cuna mountaineers have caused the writer, from his intimate acquaintance with the African pygmies, to incline to the former thesis and to see in them the possible representatives of a pygmy race. The identification of a race of pygmy Indians on the Isthmus of Panama would be intensely interesting to the student of human development because of the light that such a fact would throw on the much-vexed question of the origin and distribution of pygmies over the world. However that may be, the character and culture of the San Blas embrace some very profound studies. There are many speculative questions presented to the ethnologist and the philosophic student of human development in this little colony of aborigines in Panama—one of the most easily studied of the tribes in America now, and one which offers an exceedingly interesting problem in the early history of the hemisphere.

NEW ORLEANS IN EARLY DAYS[1]

By EDNA F. CAMPBELL

The pleasant territory of Louisiana, claimed by La Salle for France in 1682, rapidly acquired such popularity in the mother-country that its possession formed the foundation of the famous speculation of John Law known as the "Mississippi Bubble." The geography of the waterways of this region determined that New Orleans become in the early part of the eighteenth century not only the commercial center for the settlement in the Mississippi delta, but also the point about which population began to concentrate. Monette quotes Charlevoix as crediting the town in 1723 with 200 inhabitants besides troops, 100 cabins, the warehouses of the India Company, and a church. Not being protected by a levee, New Orleans was subject to inundations yearly and, according to an early traveler, looked like a vast sink in which grew a variety of tall grasses and reeds. The streets divided the town into sixty-six squares. Around each ran a ditch for drainage, and, as every lot in each square was also ditched all around, the town seemed like a "microscopic caricature of Venice."

Such was the town that was known in Paris as a beautiful city, for this period saw the climax of the "Mississippi Bubble" and Louisiana was a magic word to send emigrants from France. French pens were taxed to find sufficiently extravagant adjectives to describe this land, so rich with gold that even the thick yellow waters of the Mississippi when filtered yielded an invaluable deposit of the metal, a land which was more than "Old Eden, so long lost to mankind."

When the bubble burst, the opposite extreme was reached, and the name of Mississippi became such a terror that it was said the threat of French mothers to send rebellious children there was all that was needed to quiet them. The burden of the failure fell heavily upon Louisiana, as supplies from France were cut off. The company backing the colony struggled along a few years, but, although emigrants continued to arrive, the charter was rescinded in 1731 and Louisiana became again a royal province.

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LOUISIANA AND NEW ORLEANS IN 1731

Despite a policy unwise in many particulars progress had been made in Louisiana in settlement and development during the fourteen years' existence of the India Company. Colonization was not a national enterprise but a stock-jobbing operation. Thrifty, hard-working, home-seeking people did not dominate among the colonists, and seekers of wealth or adventure, "gentlemen of France," did not consider themselves Louisianans but Frenchmen on a brief sojourn from home.

In New Orleans and vicinity at this time there were about a thousand people. In 1727 a levee was started which was to extend 18 miles on each side of the city, with a summit-level 18 feet wide. A canal was planned from New Orleans to Bayou St. John (where Carondelet Canal was later constructed), and an effort was made, though in vain, to have the woods between New Orleans and Lake Ponchartrain cut, as it was believed that the town would be more healthful if there were freer circulation of air.

Aside from New Orleans, some important settlements had been made at Tchoupitoulas, Cannes Brulées, the German Coast, Bayou Manchac, Baton Rouge, Pointe Coupée, Second Creek, and St. Catharine's Creek at Natchez. The white population in the region was 5000 and the black was 2500 when the India Company resigned its charter. Under the new régime emigrants continued to arrive from France, Canada, and the West Indies. The character of the soil and ease of movement determined their location along the banks of the Mississippi and Red Rivers, as well as along the numerous creeks and bayous.

GERMAN SETTLERS

When the Germans who came to Law's grant learned of his fate and realized that they were abandoned in a distant part of the colony, they descended the Mississippi in a body to go home, but they were prevailed to settle along the river in what are now the parishes of St. Charles and St. John the Baptist, a region first called the German Coast and a century later known as the Gold Coast, because some of the thrifty Germans became wealthy sugar planters. They were industrious, home-seeking settlers, just such as the country needed. They engaged in farming and every Saturday night took their produce 30 miles down the river to New Orleans. It was not long before their German was forgotten and they had adopted the French tongue, but they did not lose their peculiar ability to get the most out of what they had.

ECONOMIC RESOURCES

The natural wealth of the region was becoming apparent to the colonists after years of suppression by an unwise colonial and commercial policy. Up to the close of the first quarter of the eighteenth century attention had been given largely to hunting and to trading with the Indians. About that time a change was in progress. Agriculture was beginning to flourish, and lands were becoming so valuable that surveyors were sent to straighten out the land grants.

Livestock

The livestock of the colony included 1100 cows, 300 bulls, 200 horses, 100 sheep, 100 goats, some hogs and hens. The friendly tribe of Indians at Avoyelles was the best source for procuring cattle, some of which the Indians had secured from the Spanish settlements and for which their prairie was well suited. Cattle-raising was significant in nearly every settlement along the river and especially on the small scattered prairies back of the river.

Rice and Indigo

By 1723 Lower Louisiana was growing a few staples, indigo, rice, and tobacco in fairly large amounts. Rice, brought into the valley from Carolina,[2] was an important crop, not only for home consumption but in time for exportation, being extensively grown by 1731. Indigo, first cultivated in 1726, was exceedingly profitable, and hence it tended to exclude other crops for a number of years. From 30,000 to 35,000 pounds of indigo were produced in 1736, and during the last year of French control it was the leading export, the value being more than $100,000 yearly. It was in greater demand than that of Santo Domingo, as it was of better quality and color. The crop was, however, subject to the uncertainties of the weather, and during 1793--94 it was destroyed by great swarms of locusts. Thereafter the cultivation of indigo gradually gave place to that of sugar, cotton, and tobacco.

Tobacco

Tobacco, another great staple of the province, also suffered from the uncertainties of the weather. It was a localized crop, the greater part being grown on the uplands near Baton Rouge, Natchitoches, Pointe Coupée, and Natchez and sent to New Orleans for distribution. To encourage the production of tobacco a bounty was offered by the royal government to buy all the crop at $7 a 100 pounds.

Cotton

Cotton was introduced in 1741, but for a number of years was cultivated in small quantities on almost every plantation for domestic consumption only. It was remarkable for its whiteness but was of a short fiber. Nowhere was it the entire crop of a plantation, owing to the difficulty of separating the cotton from the seed. When a cotton gin was constructed by a planter in 1751, the crop promptly became important.

Sugar Cane

The fifth and last of the great staples introduced was sugar cane. A quantity of cane, together with a number of negroes acquainted with the process of making sugar, was brought in 1751 from Santo Domingo and a small plantation started on the Mississippi just above New Orleans. Within a few years the cultivation of the cane was commenced on a small scale in most of the plantations in the vicinity of New Orleans, and in 1759 the first sugar-mill was erected. The undertaking was a failure, for, though the sugar of the province was of fine quality, lack of skill handicapped its production. The supply of sugar was soon sufficient for domestic use, but it was not an export crop till 1795, when sugar planting became more general and when the first shipload went to France. The impetus to extensive sugar planting came from the failure of the indigo crop in the year of the locusts. One of the large indigo producers, to recoup his losses, planted his land in sugar. He prospered and increased his plantation, and his example was followed by others. Indigo culture was gradually thus replaced by that of sugar and other crops.

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[2] *Hunt's Merchant's Magazine*, Vol. 9, 1843. p. 86, New York.

Lumber

Lumber was a valuable product of the region and rapidly became an important item among the exports of the period, a large amount being sent to the West Indies. New Orleans was the distributing port, and to it lumber was sent easily by way of the bayous which surrounded nearly every plantation and formed a part of the great system of channels connecting with the Mississippi River. As settlement spread to the banks of streams flowing into or away from the Mississippi, lumbering developed along them, especially as the more desirable kinds of timber became somewhat rare. Timber was one of the two leading products of the Plaquemine settlement. The flood waters of the Mississippi furnished the power by which the planters operated their saw-mills.

Cypress was preferred by the French to build their houses, as it was durable, light, and hence easy to carry, and so close-grained that it was not easily damaged by insects. By 1730, however, the easily accessible cypress was becoming rare. The black cedar and the red cedar, especially common along the coast, were considered the next most valuable woods, while the red, white, and live oaks, the ash and the elm, were largely used. Pitch and tar were produced abundantly, especially in the region between the Mississippi and Mobile, which was covered with pitch pine. In 1736 the output of the colony was about 6000 to 7000 barrels, but a larger market was needed. The production of pitch and tar, in connection with the large supply of excellent timber, inspired more than one with the possibility of the colony becoming as great a shipbuilder for France as New England was for England.

Mediterranean Tree Culture

An important product of Louisiana was the myrtle tree, cultivated by nearly every settler for the wax with which to make candles. The myrtle-wax of Louisiana was highly prized at Santo Domingo and was exported to other parts of America, as well as to France. The fig tree and the orange tree were brought from Provence and were common about New Orleans.

SILK CULTURE

An effort was made, in a small way, to establish silk culture. The mulberry tree was listed as indigenous by writers of the early part of the nineteenth century. This, however, was not the case. It was an "escape from cultivation," probably from Mexico, and, having become "naturalized," grew wild.[3] Some of the settlers believed the climate similar to that of the regions in which it was cultivated at home. There was much discussion in the effort to establish this industry, but, as in the case of shipbuilding, to no purpose.

OTHER PRODUCTS

For home consumption, the most valuable product along the banks of the Mississippi was maize, the land yielding as much as 110 bushels per acre. Yam and the West Indian sweet potato were certain crops.

Salt was manufactured along the Arkansas and Red Rivers and supplied at $1.00 to $2.00 a bushel at the works to the inhabitants of Natchitoches and vicinity.

COMMERCIAL DEVELOPMENT

Specialization in agriculture made commercial development inevitable and was the prime factor in that development. Other factors were the relative ease of communication between the settlements along the great river, the hurricanes that visited the lower region, making aid from outside necessary, and the relations of the port of New Orleans as an entrepôt between Louisiana and France.

Louisiana carried on an active trade with the Indians, with the parent country, and especially with the settlements along the Illinois and Wabash Rivers. The Illinois country was about 1500 miles from Quebec, while it was only about 1100 miles from New Orleans. Breadstuffs were a large item in the commerce with the upper part of the valley. Accounts show Upper Louisiana in 1745 to have sent 4000 sacks of 100 pounds each of breadstuffs. Other articles were beef, pork, bacon, leather, hides, beeswax, and bear's oil. In 1746 the Wabash country shipped 600 barrels of flour to New Orleans besides large quantities of hides, peltry, tallow, and beeswax.[4] Part of the shipments went to the West Indies and part to France, the rest being marketed in the lower country.

Trade between the upper and lower regions began with the coming of a boatload of produce to Lower Louisiana in 1705, but by 1720 the river trade was well developed.[5] It was carried on chiefly in large flatboats, or bateaux, of a capacity of forty tons, each manned by twenty men and equipped with oars, poles, sails, and ropes. Commonly six to twelve bateaux went together for protection, as during this time the English were inciting the Indians to attack the boats. The trip usually took about three months, and two trips were made each year by the little fleet. The return was made about December, and the load then consisted of rice, indigo, tobacco, sugar, cotton, European fabrics, and goods for the Indian trade.

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[3] O. R. Willis: Practical Flora, New York, 1891, pp. 230–231.

[4] B. A. Hinsdale: The Old Northwest, New York, 1888, p. 50.

[5] J. W. Monette: Progress of Navigation and Commerce on the Waters of the Mississippi River and the Great Lakes, *Mississippi Hist. Soc. Publs.*, Vol. 7, 1903, p. 483, Oxford, Miss.

WANDERING STORMS

By **ALEXANDER McADIE**

Harvard University

Sir Napier Shaw, director of the British Meteorological Office and, during the war, scientific adviser on meteorology to the British Government, is now engaged with his colleagues in the preparation of a four-volume "Manual of Meteorology." Part I will give a general survey of the globe based upon the work of Hildebrandsson, Teisserenc de Bort, and others; Part II will deal with the physics of the air; Part III will contain a formal exposition of the thermics and dynamics with which modern meteorology deals; and Part IV, which has been issued in advance of the others[1] and is, in a way, a war product, discusses the relation of the wind to barometric pressure and the travel of cyclones. There were so many calls from insistent and impatient aviators that it was thought wise to attempt a general exposition of the probable paths of storms; the relation of surface wind to the so-called geostrophic wind, i.e. the component wind due to the rotation of the earth as distinguished from the cyclostrophic component due to the curvature of the path; the variation of wind with height; turbulence; gustiness; and cloud sheets.

THREE UNUSUAL STORMS

As a frontispiece to the manual, Sir Napier Shaw uses three storm paths of unusual duration and remarkable recurvatures.[2] The details of these long-lived storms are given in Chapter 10 of the book, and we shall mention only a few facts connected with them.

The first storm is one of the typhoon, or *baguio,* type charted by the writer (Fig. 1). Detected first in latitude 15° N., longitude 148° E., in the western Pacific, on November 20, 1895, we can trace its wanderings halfway around the world. It reached the coast of British Columbia on January 12, 1896, and was stopped in its eastward course by an Alberta "high," or cold wave. Meanwhile the southern disturbance struck the coast of California at San Francisco on January 13 and presumably passed rapidly southeastward. In all probability the disturbance was over the valley of the Colorado on January 14 and merged in a large ill-defined depression following the advancing "high;" but we have not joined the storm centers, as definite data for this large area are lacking. That portion of the storm remaining over California worked its way slowly northward, with a tendency to recurve, but finally crossed the continent, well to the north, disappearing in the Hudson Bay section on January 20, 1896. If we assume that the southern storm preserved its identity, we find it moving steadily eastward, then northeast over the Atlantic, to disappear south of Iceland about January 22, 1896. This is the longest storm path and longest duration (64 days) yet recorded, but it is quite possible that other disturbances have lasted longer and traveled farther. This storm is also remarkable for the number of recurvatures. The resultant force which drives a cyclone eastward in temperate latitudes seems to have been reduced to a minimum several times in the storm's career.

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[1] Sir Napier Shaw: Manual of Meteorology, Part IV: The Relation of the Wind to the Distribution of Barometric Pressure. xvi and 166 pp.; maps, diagrs., ills., index. *M[eteorol]. O[ffice Publ. No]. 234.* Cambridge University Press, London, 1919. 12 s. 6 d. 10 x 7 inches.

[2] The detail with which these storm tracks are shown at sea may at first sight cause surprise. But the fact is that the network of weather-reporting ships, especially along the trade routes, is often as close as that of land stations in an area of the same size. The tracks shown are based upon data published by the Deutsche Seewarte of Hamburg, supplemented by U. S. Weather Bureau and U. S. Hydrographic Office reports.

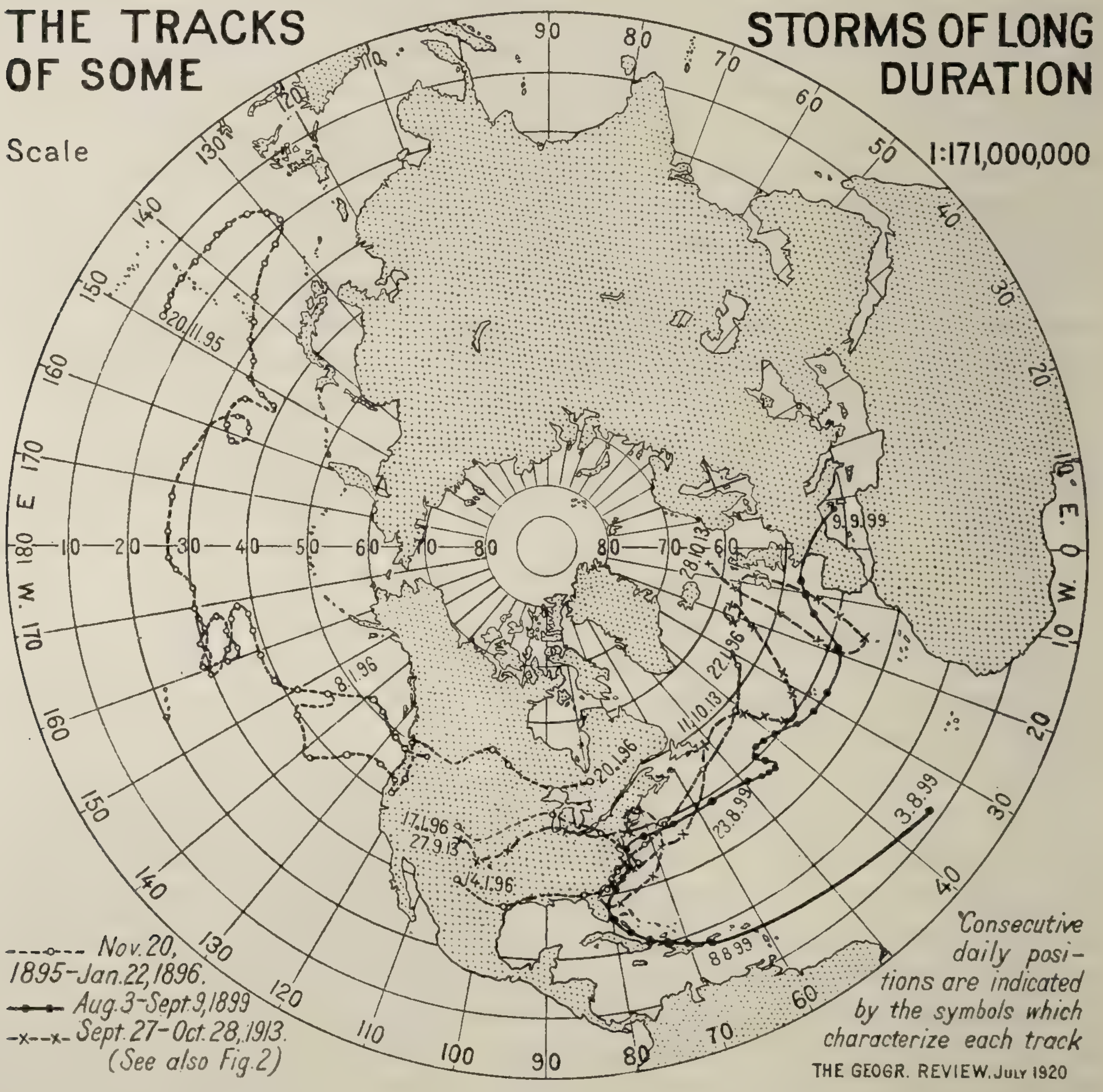
THE TRACKS OF SOME STORMS OF LONG DURATION
Scale 1:171,000,000
20.11.95
8.1.96
20.1.96
17.1.96
27.9.13
4.1.96
22.1.96
11.10.13
28.10.13
9.9.99
23.8.99
3.8.99
8.8.99
---o--- Nov. 20, 1895-Jan. 22, 1896.
—•— Aug. 3-Sept. 9, 1899
-x--x- Sept. 27-Oct. 28, 1913.
(See also Fig. 2)
Consecutive daily positions are indicated by the symbols which characterize each track
THE GEOGR. REVIEW, July 1920

Fig. 1—(Based on frontispiece of Sir Napier Shaw's "Manual of Meteorology, Part IV.")

The other storms are of shorter path and duration but of great interest, as they also show erratic paths (Fig. 1). The West Indian hurricane of August 3, 1899, detected in latitude 11° N. and longitude 35° W., recurved five days later off the Florida coast, journeyed leisurely northeast, reached the mid-

Atlantic twenty days after its first recognition, then halting, reversing, and doubling on its own track, finally moved east, passing over southern France on September 8–9 and thence rapidly southeastward across the Mediterranean.

The third storm, so far as can be now ascertained, developed near Great Salt Lake and disappeared near Lapland. Three recurvatures can be identified. After leaving the American continent on October 2, 1913, it pursued a most erratic course and was centered near Ireland on October 21. It then shot southward, missing Great Britain, and for four consecutive days moved at the rate of 600 kilometers per day, that is, 15 miles per hour. Doubling on its track it made an even more rapid and direct northing and passed over the Faroe Islands, headed for the Lapland coast. The path is so unusual and has such a bearing upon transatlantic steamship routes that we have plotted it, on a larger scale than that on which it is shown in Figure 1, on a map in Mercator's projection (Fig. 2). One can readily see how a storm like this nullifies the forecasts.

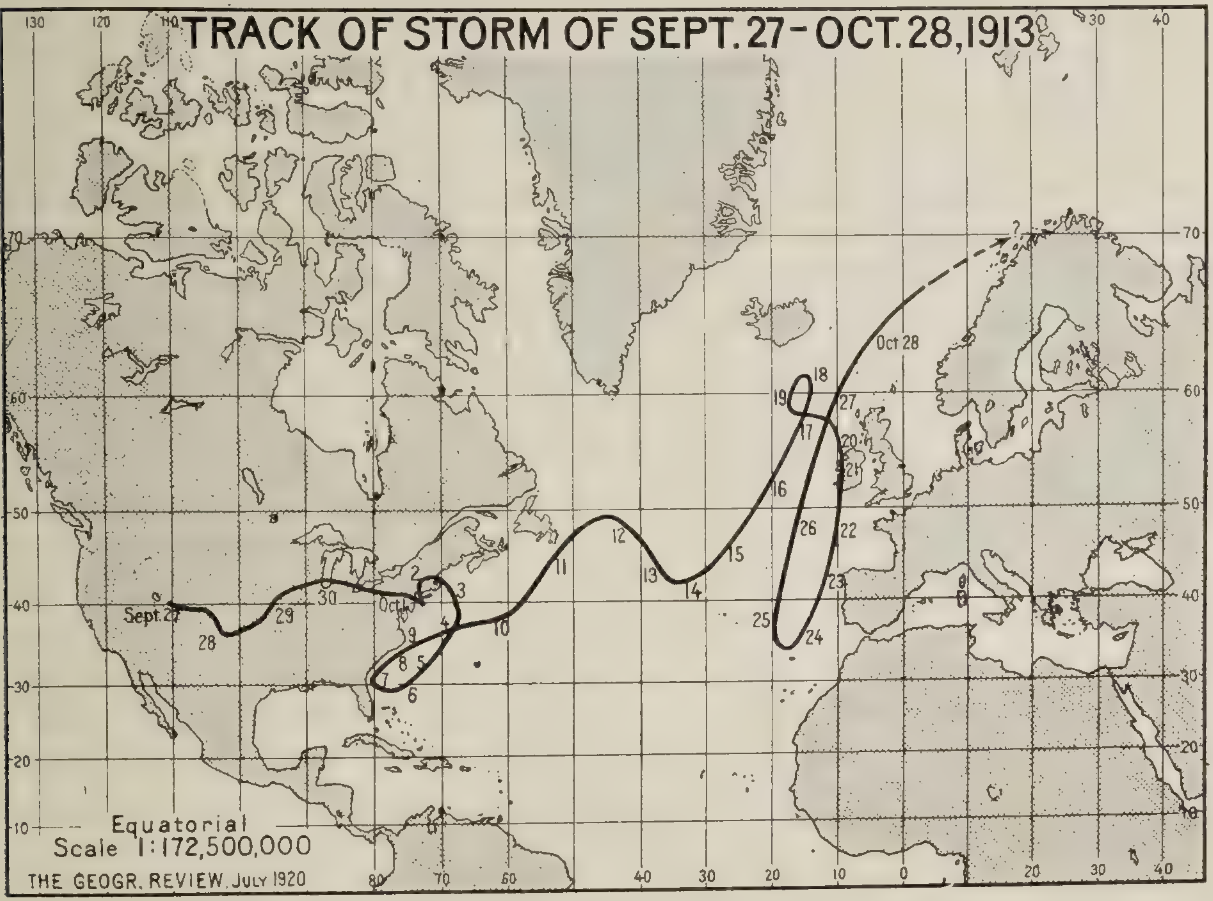

Fig. 2

Need of Accurate Aërographic Data for the Aviator as Illustrated by the Transatlantic Flights

Granted that transoceanic steamship traffic requires the fullest possible knowledge of storm tracks, how much more important are accurate aërographic data for airship movements! The airman who attempts a flight of even limited duration needs much information, while the long-distance flyer simply trifles with fate if he ascends in ignorance of what the map shows regarding the location, path, and structure of an approaching storm. In these days of long flights, like those between England and Australia and even the shorter transatlantic and transcontinental flights, the aviator must "lean, and lean heavily," upon the aërographer. I quote these words because they are the identical words used by Commander J. H. Towers, U. S. N., in charge of the transatlantic flight by the Navy-Curtiss seaplanes in May, 1919, when asking the writer to supervise the aërographic work connected with that flight.[3]

After leaving Rockaway, the first stop in the flight of the seaplanes was in Halifax harbor. Here, on the U. S. S. *Baltimore*, under Captain Cluverius, U. S. N., the writer established an aërographic observatory. More than one hundred observations of the usual surface conditions were made, supplemented by numerous pilot-balloon flights. Twice daily a weather map was drawn, based on extensive reports from the Weather Bureau. Similar work was done at the next station, Trepassey Bay, Newfoundland, and reports were received from a string of destroyers and some battleships, stretching to the Azores and on to Lisbon. The story of the struggle of the planes with wind and weather, fog and heavy seas has been graphically told by Westervelt, Richardson, and Read.[4]

Hardly was this transatlantic flight accomplished before Alcock and Brown in a swallow-like dart crossed without stop, in 16 hours, the 3,115 kilometers between Newfoundland and Ireland. *Favorable northwest to southwest winds made the flight possible.* By the first of July, the big British dirigible R34 was ready and made the trip westward in 108 hours. All that modern science could do to aid was done, and her return passage, made in 75 hours, illustrates well the value of a knowledge of storm location and path. What Commodore Maury accomplished for the clipper ships of his day, the British and American aërographers did for the airships of July, 1919.

NEED IN FORECASTING OF KNOWLEDGE OF RECURVING STORMS

So the forecaster of today must be on the alert to detect any tendency of the passing storm to recurve. Most storms travel on anticipated paths, though the velocities may vary from ten to forty miles an hour. Sometimes a storm will cross the Atlantic in three days, and again, as we have seen, some require weeks. Some never get across. Of this last class, the most remarkable illustration in a collection of erratic transatlantic storms covering a period of ten years is, in the judgment of the writer, that of May 8 to June 6, 1910.

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[3] Cf. the note "The Meteorological Aspects of the Recent Transatlantic Flights," *Geogr. Rev.*, Vol. 7, 1919, pp. 419-421.

[4] The Triumph of the N C's, Doubleday, Page & Co., New York, 1920.

This storm (Fig. 3) well deserves the name "cyclone," if the term is used in the sense in which Piddington, who coined the word, first used it, namely, the coils of a serpent, for it twists and turns upon itself. We have tracked it from the Strait of Juan de Fuca to the Grand Banks, whence it recurved again and again and came back to the continent on May 26. Here it met and merged with a storm that was moving north from Texas; and the new combination moved slowly east over Nova Scotia. Notwithstanding this increase of storm energy, the forces compelling a northerly direction—strong south winds due to a marked North Atlantic hyperbar—still prevented progress east; and for more than ten days, until June 7, this "low" remained practically stationary southeast and east of Nova Scotia, dissipating in showers and thunderstorms. In the history of a storm like this will be found eventually the solution of the problem of accurate seasonal forecasting.

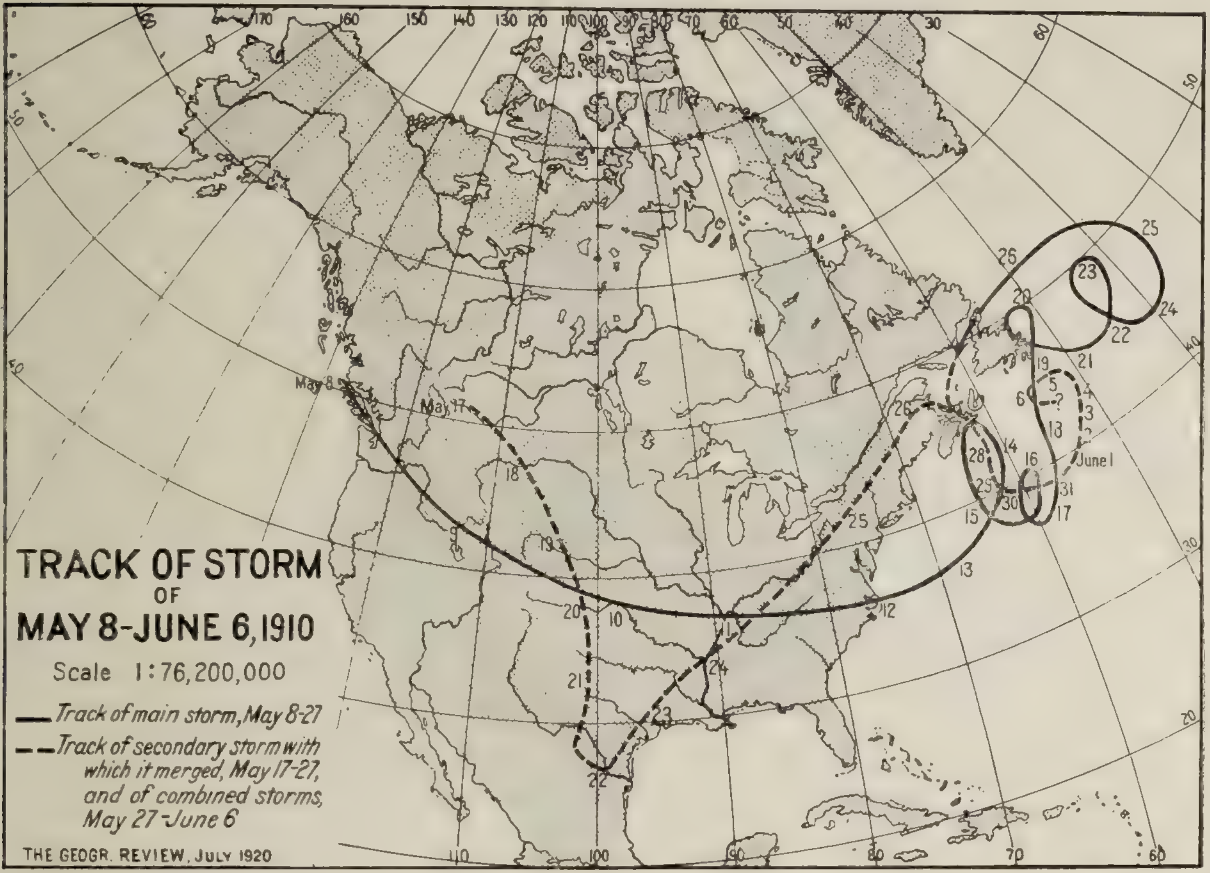
TRACK OF STORM
OF
MAY 8-JUNE 6, 1910
Scale 1:76,200,000
Track of main storm, May 8-27
Track of secondary storm with which it merged, May 17-27, and of combined storms, May 27-June 6
THE GEOGR. REVIEW, JULY 1920
May 8
May 17
June 1

FIG. 3

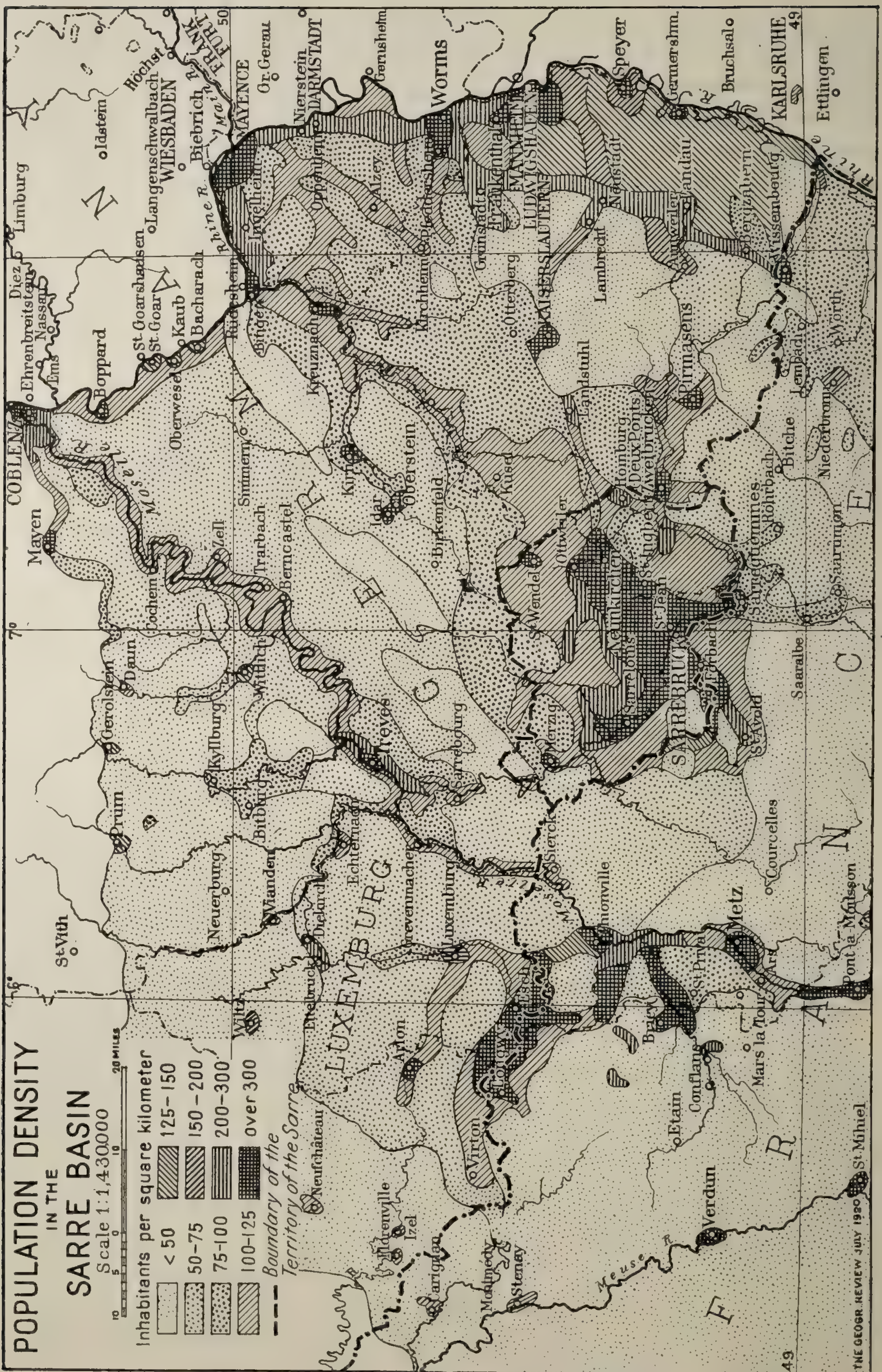
POPULATION DENSITY
IN THE
SARRE BASIN
Scale 1:1,430,000
10 5 0 10 20 MILES
Inhabitants per square kilometer
< 50
50-75
75-100
100-125
125-150
150-200
200-300
over 300
Boundary of the Territory of the Sarre
THE GEOGR. REVIEW JULY 1920
LUXEMBURG
FRANCE
GERMANY
SARREBRÜCK
COBLENZ
MAYENCE
WIESBADEN
DARMSTADT
MANNHEIM
LUDWIGSHAFEN
KAISERSLAUTERN
KARLSRUHE
Metz
Treves
Verdun
Worms
Speyer

Fig. 1

GEOGRAPHICAL RECORD

EUROPE

A Population Map of the Sarre Basin and Adjacent Regions. Four papers by Vidal de la Blache and Lucien Gallois in No. 154 of the *Annales de Géographie* (July 15, 1919) comprise a historic and economic study of the Sarre Basin. The fourth paper, "La répartition de la population dans le bassin de la Sarre et les régions environnantes," is accompanied by a colored population density map, reproduced herewith in black and white (Fig. 1). Extension of the area to cover adjacent regions brings out the unity and individuality of the Sarre Basin. On the area thus shown distribution of population is markedly unequal. Such inequality, a relatively recent feature in these lands of old civilization, is the usual resultant of industrial development. Apparently it is to be a law of future population distribution.

On the map three areas of dense population (over 150 to the square kilometer, or about 400 to the square mile) are separated by areas of thinner population, areas in large part occupied by forests, as those of the Hardt and the Hunsrück. Of the areas of dense population that of the Rhine Valley is the most stable, for it rests chiefly on an agricultural basis. The spots of highest density, over 800 to the square mile (over 300 to the square kilometer), are round the commercial centers, Coblenz, Mayence, Worms, Speyer. Ludwigshafen and its environs is the only point of large-scale industry. In the agricultural country it is interesting to note the differences in density coincident with the differences in cultivation. The band of denser population running northward from Weissenburg (Wissembourg) along the hills bordering the Hardt and continuing to Mayence and Bingen is *par excellence* the zone of vine cultivation.

Coal is still the prime factor in industry, and industrial agglomerations are most typically developed on the coalfields. The most compact and dense grouping on the map corresponds with the coalfield of the Sarre Basin (compare the mineral resources map of Alsace-Lorraine, *Geogr. Rev.*, Vol. 6, 1918, opp. p. 112), where the density exceeds 800 to the square mile. This block of high density is surrounded almost completely—except to the south, where it terminates abruptly against the forests of Carlsbrunn and St. Avold—by a zone of population density between 260 and 320 to the square mile (100 to 125 to the square kilometer), also dependent on the coal basin. This transition zone houses workers who come in daily to the mines, the foundries—glass and pottery—and factories by the railroads that thread the valleys.

In some respects the Sarre Basin is industrially unique. There are few such regions where population is so stable and so firmly implanted. An example from statistics lately collected by the French will show this. Out of a group of 3,500 residents, the majority miners or metal workers, 80 per cent were natives of the region and 73 per cent sons of fathers native of the region. In this connection the effects of French exploitation may prove interesting. The Peace Treaty stipulates that "no impediment shall be placed in the way of introduction or employment in the mines and their accessories and subsidiaries of workmen from without the Basin."

It is otherwise with the industrial agglomerations of the Moselle. The grouping here is much less compact and the transition to zones of sparser population more abrupt. The labor includes a very large foreign element, Italian, Flemish, Polish. In the *arrondissement* of Briey foreigners outnumber the native population. The intense industrial growth has been of recent date. It began with exploitation of the Briey mines in 1880 and introduction of the basic process of steel manufacture. Transformation has been too rapid. The consequent maladjustment between man and the soil is something quite foreign to France.

The Influence of Geography on the Conduct of the War. The importance of geography as shown by the war formed the subject of an interesting discussion at a meeting of the Geography Section of the Educational Congress held at Harrisburg, Pa., November 17–22, 1919. Mr. Alfred H. Brooks of the U. S. Geological Survey presented a paper entitled "The Influence of Geography on the Conduct of the War," in which he gave a broad classification of the various factors involved ("Proceedings of Educational Congress, November 17 to 22, 1919," Dept. of Public Instruction, Commonwealth of Pennsylvania, Harrisburg, Pa., 1920, pp. 540–547). Mr. Brooks served as Lieutenant-Colonel of Engineers and Chief Geologist of the American Expeditionary Force. A brief summary of his discussion follows.

The making of war is largely a matter of applied geography. The conduct of war includes (1) military field operations, or the manoeuvering of armies, and (2) the supplying of armies, both of which are to a great extent controlled by geographical factors, such as relief, drainage systems, population, and natural resources. Though the following classification is primarily geographical, an attempt is made to indicate the most important military bearing of the various factors by classifying them under three heads: (1) those influencing general military policy; (2) those influencing the strategy of the campaign, the general plan of operations; (3) those affecting tactics, the details of operation in the face of the enemy.

In determining the general military policy, the prime factors are those of population and natural resources. The significance of the total population needs no comment, while its distribution and density have a very considerable effect. Wide distribution and a lack of homogeneity in the population are decided military handicaps, while a high degree of density of population, if in rear areas, is an evident advantage, though in the immediate theater of war, as in France or Belgium, it hampers defense. The adequacy of the natural resources available for the needs of the population and the fighting forces must also influence policy. The cessation of imports due to the Allies' control of the sea routes put the Central Powers at a great disadvantage because of their lack of several essential minerals and the insufficiency of their agricultural resources.

In all phases of strategy, or the general plan of campaign, the dimensional factor is of prime importance. To give only two of the obvious examples, the width of the zone of operations determines the number of troops necessary, while the length of the line of communication between the front and the supply base is a vital consideration. In this connection it is interesting to compare with our own the length of the line of communication between Germany's front and her source of supplies. However, it is in such physical features as the coast line, relief, and drainage systems that the full significance of the dimensional factor is most apparent.

The length and nature of the coast line, the character of adjacent waters, and the harbors must determine the mode of defense or attack. The long coast line of the Allies was difficult to maintain and, indeed, necessitated naval control. On the other hand, Germany's base on the North Sea, with its adjacent shallow waters and winding approaches, could be held with little effort, while the easily defended entrance of the Baltic (Kattegat) practically rendered it a German sea, thus giving the Central Powers access to the resources of Sweden and Norway. Again, Russia's lack of an open port on her European frontier and the consequent want of contact with her allies was a decisive factor in her military downfall.

The importance of the dimensional factor is again evident in relief, especially in the larger features of relief. The extent of mountain ranges, the symmetry of the ridges, and the character of crest lines, whether continuous or broken by passes feasible for military operations, must control strategy. An excellent illustration of this is afforded by a comparison of the great Alpine chain with the Carpathians, whose length is cut across by many passes, or with the short range of the Vosges, having routes of approach around both sides. An unbroken plateau, such as the central district of the German African colony of Cameroons, is easy to traverse once the summit is attained, while a plateau broken by numerous valleys affords a difficult terrain for military operations. Swampy lowlands greatly hamper the manoeuvering of armies, while naturally well-drained lowlands facilitate troop movements.

An important rôle in strategy is played by the drainage system in the theater of operations, its direction relative to the zone of advance or retreat, the spacing of its streams and the location of its divides. On the eastern front the tide of battle swept back and forth across the principal waterways, and each river offered a locus of resistance and an obstacle to attack, while on the west the German invasion followed up the tributaries of the Rhine. The irregular topography caused by close spacing of watercourses, as in the Argonne of northern France, is admirably adapted to defense, but the more broadly spaced interstream areas, as in northeastern France, permit of the rapid advance of attacking troops. In the highlands a more feasible line of defense is found where the watersheds coincide with the crest lines, as in parts of the Alps, rather than where the upper valleys head back of the mountains. A natural feature of this latter type was utilized by the Rumanian army in its invasion of Hungary, when the Rumanian offensive followed up the gaps in the Transylvanian Alps formed by the valley of the Alt River, whose headwaters lie back of the mountains. The dimensions, the slope of the walls, and the physical character of the valley floors will also evidently exert an influence on military operations, though this influence will be felt more on details of troop movements than on general strategy.

The tactics of modern warfare are largely controlled by physical features. The heavy equipment of modern armies, the use of airplanes and balloons, and the employment of poison gas demand that the details of military operations take into account such governing factors as watercourses, surface formation, climate, and vegetation in the war area. Not only the dimensions, but also the volume and velocity of streams and their rate of fluctuation (varying according to the season of the year) are important because the ease or difficulty of crossing a river with infantry, artillery, and tanks may be a decisive element in a given battle.

The physical conditions of the surface formation controls the movements of heavy artillery and tanks, which can be manoeuvered only on fairly hard ground; and a heavy soil and subsoil, if porous, may become impassable for such troops during a rainy season. Again, the construction of field works, such as trenches, dugouts, and mines, is affected by the condition of the soil and subsoil, as well as by the depth to ground water; and where such conditions are adverse, as in the plains of Flanders and on many of the Russian battlefields, elaborate defensive works are impracticable.

Climate is chiefly important in tactical movements, though the seasonal temperature affects the general plan of campaign, and a similar control is exercised on strategy by extremes of seasonal precipitation. The use of airplanes and of poison gas has made the direction and velocity of wind and the magnitude and frequency of storms important. The airplane and balloon observations of modern war have also rendered significant the distribution of vegetation, whose chief value consists in affording cover for troop movements.

It is difficult to make choice of the geographical factors significant enough to set forth in such a brief presentation, and the limited space makes it impossible to cite examples of the many influences, but the student of the geography of the war, by the use of good maps, can find many applications of the principles here set forth. This note, however, may serve to emphasize the existing relationship between the art of war and the science of geography.

The Meteorological Service of the German Army During the War. Translations of German documents containing accounts of the meteorological work carried on by the German army during the war bring to light many interesting facts not hitherto known (*Monthly Weather Rev.*, Vol. 47, 1919, pp. 871-874). It is evident that special attention was paid to meteorological conditions when gas shells were to be used. The usual decrease in wind velocity during the night led to the use of such shells chiefly in the early morning hours. For the use of gas mines, nights were chosen when the air was not completely calm, but when there was a gentle wind blowing towards the enemy lines. The wind directions in central Europe, arranged according to their frequency, beginning with the least frequent directions, are given as SE, S, E, NE, N, NW, W, SW. The marked prevalence of westerly winds is thus emphasized. "For firing the gas," an official German document says, "it is not always necessary that the wind blow absolutely against the enemy perpendicular to our trenches; a variation as great as 60° from the normal is permissible." The gas being heavier than air, a terrain sloping toward the enemy was more favorable than a flat surface. During a gas attack, observations of wind direction were made continuously and of wind velocity every half hour. A sample report, issued by the army meteorological service, for a position facing the west, is the following:

"You do not need to fear a gas attack today, for we can count on a gentle east wind; on the contrary, it will be possible that during the morning the enemy may make a gas attack, for a complete calm is forecast for that time. This applies especially to the places where the slope rises toward the enemy."

The evidence contained in the translations of these official reports shows very clearly, as was indicated in several of the articles published by the writer of the present note during the war, that the German military meteorological service was a highly efficient organization, which was a very distinct assistance in planning, and in carrying out, military strategy of all kinds.

R. DeC. Ward

ASIA

Climate and Human Efficiency in Korea. Dr. J. D. Van Buskirk of the research department of the Severance Medical College at Seoul, Korea, has for several years been engaged in "a study of the physiology of the Korean people." In this he has paid special attention to diet and climate. The results of his climatic studies appear in the *Transactions of the Korea Branch of the Royal Asiatic Society*, Vol. 10, 1919, No. 15. He begins by giving much the best summary of the Korean climate yet available. Atmospheric pressure is dismissed as of only minor importance so far as the direct effect on man is concerned. Seasons, temperature, humidity, rainfall, storms, winds, sunshine, and clouds, however, are all considered, and valuable tables are given. The most marked characteristics of the climate are the cold, clear, bright winters with considerable variation from day to day, and the warm, rather humid and cloudy summers with little variation from day to day.

Turning to the effect on man, Dr. Van Buskirk finds that so far as mean monthly temperature is concerned there is no great difference in the effect of the climate in Korea and the eastern United States in similar latitudes, that is from Wilmington, Del., to Portsmouth, N. H. But "there is a difference in favor of the United States on account of the humidity and lack of storms and variability in . . . . Korea. It is the feeling of almost everyone when he first arrives in Korea from the United States that the climate is very fine, but before many months have passed we all find it hard to keep up ambition and energy, and it is matter of common knowledge that we do not recuperate so quickly here as in the homeland." Among other troubles neurasthenia is common. "It is not alone this running down of Americans. . . . . the impression gained by even casual observers is that the people of Korea are not . . . . of great vigor. . . . . Many factors would each partially account for this, but . . . . climate is one important factor." The summer conditions of "humidity, lack of the stimulus of changes—lack of 'weather'—and possibly the excess of light" react, or else fail to cause a reaction, "and the very physical tone of the body is reduced." When we compare the people of northern and southern Korea, "there is a difference in favor of the Korean from the northern part. . . . . In this, too, climate forms an important but not the only factor."

Dr. Van Buskirk's study of the Korean climate is an excellent beginning. It will be greatly strengthened when the human side is worked out as carefully and as statistically as the climatic side. Perhaps a correlation of climatic conditions with deaths and hospital cases, together with daily tests of the strength of individuals, would give the desired information. One of the greatest needs today in the field not only of geography, but of medicine, anthropology, sociology, economics, and history is a fuller understanding of the part played by health and energy in determining racial or national character.

Ellsworth Huntington

POLAR REGIONS

On the Sudden Discharge of Icebergs from Greenland's Fiords. To the first number of *Geografiska Annaler*, the new journal of the Swedish Anthropological and Geographical Society, to which reference was made in the preceding number of the *Review* (Vol. 9, p. 368), Morten P. Porsild, the director of the Danish Arctic Station at Godhavn, Greenland, contributes an important article on the so-called "outshooting" of icebergs from the Greenland ice fiords, a phenomenon characterized by a sudden, catastrophic discharge of great volumes of ice from certain fiords (Om de grönlandske Isfjordes saakaldte Udskydning, *Geogr. Annaler*, Vol. 1, 1919, pp. 149–157). The phenomenon has been recorded several times, and the term has become a part of glacial terminology among the Danes and Eskimos, but the process has never been well understood. Herr Porsild after many years' observation and study offers the following explanation:

He divides the ice fiords into types, with gradations between: the Torssukatak type, named from Torssukatak Fiord and characterized by a long-continued, quiescent winter period and a brief summer period, interrupted by a single catastrophic discharge; and the Jakobshavn type, named after Jakobhavn Fiord and characterized by no definite winter or summer period and numerous sudden discharges.

After carefully weighing the evidence he has collected and studying his observations, Herr Porsild concludes that the phenomenon is caused by great masses of water dammed up behind and under the ice, which in times of abnormal melting—as during the prevalence of the Arctic föhn or the summer freshets—accumulates in such abnormal quantities that it finally disrupts the glacier front and forces incredible masses of ice out to sea. He states that every spring he observes a similar phenomenon on a small scale in a little alpine brook that tumbles down the precipitous mountain slopes near his station.

The two types of fiords result from differences in the glacier bed and the basin that it occupies; the number of tributary branches; the capacity of the fiords; the character of the outlets; and the rate of accumulation of the icebergs off the face of the glacier.

Resulting from his firsthand, careful observations, and written in Herr Porsild's clear and illuminating style, the article constitutes a most valuable contribution to the literature of glaciology and geography and merits the attention of every physiographer.

W. Elmer Ekblaw

MATHEMATICAL GEOGRAPHY

Quantitative Mapping by Natural Regions. In an article entitled "A New Method of Mapping Complex Geographical Features Illustrated by Some Maps of Georgia" (*School Science and Mathematics*, Vol. 18, 1918, pp. 699–708) Dr. Roland M. Harper describes a method which, when perfected, may prove of much practical value. The gist of the method is to determine for each geographical province the percentage of each of the things to be mapped and then to insert the names in order of their importance with proper indications as to the amount of each. For example, suppose we desire a forest map. Data are collected as to the percentage of trees of each of the main kinds as determined by actual counts such as Dr. Harper has made in each of the natural regions of Georgia, and the names are inserted in each province in the order of their importance. Such a map tells far more about the actual forest than do any of the types of forest maps now available except those on a very large scale, where each individual area can be shown. Or take crops as an example. In the "wire-grass country," which forms a belt running southwest from a point about half way from Augusta to the sea, the crops fall in the order indicated in column 1; while in the next two regions to the southeast, namely the "flat pine lands'" and the "coast strip," the order is as shown in columns 2 and 3 respectively:

(1) *Wire Grass Country*	(2) *Flat Pine Lands*	(3) *Coast Strip*
Cotton	Cotton	Corn
Corn	Corn	Cotton
Sweet Potatoes	Sweet Potatoes	Rice
Peanuts	Sugar cane	Sweet potatoes
Sugar cane	Peanuts	Sugar cane
Vegetables	Oats	
Oats		
Hay		
Cowpeas		

A series of black-and-white maps giving in this way not only the crops, but the percentage of different kinds of soil, trees, manufactured products, and perhaps other things would give a fuller idea of each natural region than do the highly colored and complex economic maps which now are attempted, but which are too confusing for ordinary use. If lines were added in each province showing the relative amount of each of the items named in the map ,the value would be still greater.

Ellsworth Huntington

PHYSICAL GEOGRAPHY

The Climatological Aspect of Radiation. Dr. C. Dorno, on becoming a resident of the high mountains in Switzerland fourteen years ago, "was soon convinced that radiation there presented one of the most important climatic factors," which had been guessed at rather than accurately measured. With a zeal that has raised him to a position of recognized authority on solar and sky radiation he set about measuring "the well-known chief effects of radiation, namely calorific, luminous, chemical, and bactericidal." His results of many years—of wide applicability, but especially in medicine and ethnography, because of their bearing on heliotherapy and human pigmentation—Dr. Dorno has now presented in interesting, non-technical form (On Observations of Solar and Sky Radiations and Their Importance to Climatology and Biology and Also to Geophysics and Astronomy, *Monthly Weather Rev.*, Jan., 1920, pp. 18–24 [translation]).

From the unquestionable physiological importance of solar radiation and the fact "that the differences in absolute amount of radiation and in distribution through the day and the year, from place to place, are far greater and, therefore, more characteristic than those of the other meteorological elements . . . . it might be concluded that for different climatic effects radiation (both incoming and outgoing) is among the most decisive elements." Solar radiation differs widely in its ray elements even at the same place, and for the same solar altitude and apparent clearness of the sky. "The spring sunlight is—at least on the Alpine heights—much richer in heat rays, that of autumn much richer in the ultra-violet ones." We are accustomed to think of sky-light as being a definite, though changing, percentage of direct sunlight: on the contrary the relation is by no means simple. "With middle sun elevations and cloudless sky the red light of the sun falling on the horizontal surface is found to be 14 times stronger than that from the sky, while its brightness is only 11 times stronger, its chemical rays only 4.4 times, its pure ultra-violet (bactericidal) rays even less strong than those of the sky (only about half so powerful)." Evidently, when we speak of "sunlight" we are using a broad generalization. Charles F. Brooks

HUMAN GEOGRAPHY

Wind Maps for Aviators. Mention of new developments in plotting the direction and force of air currents recalls the work so successfully initiated by Lieutenant M. F. Maury in 1847. The publication, in that year, of his "wind charts" ushered in a new era of navigation, since prior to that date mariners had been unguided in the selection of their routes save by tradition and their individual experience. Following Maury's lead, Brault, Buys Ballott, Fitz Roy, and others perfected the undertaking, until now the surface winds over the ocean are mapped in detail on the "pilot charts" of the leading maritime nations. With the advent of aërial navigation it becomes necessary to extend that work so as to cover not only the ocean but the land, and to map the course and velocity of winds at varying altitudes as well as surface currents. Data for the use of aviators had already been collected in several European countries before the war brought aviation to its present development (see note in the *Bull. Amer. Geogr. Soc.*, Vol. 42, p. 530), and in America Professor A. Lawrence Rotch (in collaboration with Andrew H. Palmer) had published his "Charts of the Atmosphere for Aeronauts and Aviators" (New York, 1911). But such studies either covered small areas or were very much generalized. Rapid progress was made during the war, and recently some of the wind maps prepared have been published (see "Les cartes des vents à l'usage des aéronautes" by J. Rouch, Chef du Service Météorologique de la Marine, and L. Gain, *Rev. Gén. des Sci.*, March 30, 1919, pp. 168–171). Three maps of the western Mediterranean are reproduced in this article, one showing surface air currents, another those at 1000 meters, and the third those at 2000 meters altitude. Wind roses, showing the frequency of principal winds and their force according to the Beaufort scale, are given on each map for ten different stations about the coasts. The value of such maps is patent. They will be of even greater service to aviators than are the pilot charts to sea navigators, since the former enjoy greater latitude in the choice of routes and are able to make detours either horizontally or vertically in the ocean of air in order to obtain the most favorable or least contrary winds. The maps show clearly that an aviator traveling between two points may find it advantageous to go at one elevation and return at another, either because he finds the air currents at different levels moving in opposite directions or because they blow with different velocity at varying altitudes. For example, the journey from Oran to Tunis should be made at about 2000 meters elevation, thus gaining the assistance of a strong westerly wind, while the return should be made at an altitude of less than 1000 meters, where the westerly blows with greatly diminished force. Similar conditions are found in most localities, emphasized where topography exerts a marked influence on surface currents or where the passage of cyclonic disturbances interrupts temporarily the general circulation of the atmosphere. Seasonal variations in the movement of air currents are so pronounced and the aviator's dependence upon these currents so great, in order that he may travel with least expenditure of time and power, that wind charts will have to be issued frequently, perhaps more frequently than the monthly issues of the pilot charts.

For the construction of these wind maps the organized co-operation of aviators will be required, since each chart entails the correlation of very numerous data. The wind chart which forms Plate I in Maury's "Physical Geography of the Sea" (New York, 1855, p. 70) is said to have been the product of 1,159,353 separate observations on the force and direction of the wind and of more than 100,000 observations on the height of barometer at sea. The collection of data sufficient for satisfactory charts of winds at different altitudes will be possible only with the assistance of a great number of observers, organized under some such arrangement as that effected by Maury or by the British Admiralty which in 1850 made it obligatory for masters of ships to keep a uniform log and report the results of their observations to the Hydrographic Office.

GEOGRAPHICAL REVIEWS

Climate and Evolution

Ellsworth Huntington. **World-Power and Evolution.** 287 pp.; maps, diagrs., bibliogr., index. Yale University Press, New Haven, 1919. $2.50. 9 x 6 inches.

Dr. Huntington has given us another stimulating discussion of climatic influences. Whereas formerly he has concerned himself chiefly with space relationships, he now undertakes to outline the importance of climate to evolution. In his own words, "the problem of the effect of the physical environment upon human progress . . . . is considered in its relation to time" (Preface, p. 1).

In order to handle his problem, the author has taken a long view of evolution, which he has measured with the pendulum of climatic changes, borrowed for the purpose from his earlier dissertations on the subject. The matter brought over from former studies is amplified by additional data. These data are derived from numerous and diverse fields of knowledge, and the conclusions which are drawn from them are woven together with the brisk skill which we have learned to expect from Dr. Huntington.

On the basis of a statistical study of variations in the death rate, success of applicants taking Civil Service examinations, consumption of alcoholic liquors, school attendance, bank clearings, general prices, national bank deposits, immigration, and yield of crops is evolved the hypothesis that waves of prosperity and of adversity are directly impelled by variations in the health of a community. A detailed investigation of the death rate of nineteen separate places in relation to the temperature, humidity, and variations of temperature and humidity of those places is adduced to show that health varies with fluctuations in the weather—directly, markedly, and in accordance with certain recognizable principles. To fortify these conclusions a chapter is devoted to a discussion of the results of several experiments with schoolrooms of different temperature, humidity, and variation.

After carefully and at length laying the foundations for his thesis, the author begins upon the superstructure, which is the product of an equally extensive search for materials. A number of biological experiments are quoted to illustrate the principle and the conditions of mutation among lower types of animals; and certain anthropological and sociological data are recapitulated to bring out the fact that mutations have occurred and are occurring among men. The results of all these experiments are referred to the common denominator—climatic change.

Finally, Rome, Turkey, and Germany are selected as examples of units which illustrate the workings of the hypothesis. The data for Rome are furnished by history and measured by the results of the author's study of the growth of big trees in California; Turkey is treated chiefly in the light of personal experience and a study of climatic changes in past centuries in Western and Central Asia; Germany is viewed as a present and future world problem.

From the foregoing recapitulation a suggestion of the scope of the work may be derived. Covering in the space of 250 printed pages the tremendous dynamic swing of the eons and the vast intricacies of several fields of human knowledge, it must in the nature of things be open to attack as superficial. Doubtless the author would be the first to admit the weakness of his position. At any rate he candidly acknowledges the limitations of accessible material on which conclusions are based, and he is at great pains to describe in detail the exact statistical methods used in arriving at those conclusions. As a matter of fact, this very care results in overloading parts of the text with methods (e.g. pp. 91–94), and, although there is obviously a sincere attempt to elucidate the use made of statistical material, it curiously enough has the unfortunate effect of causing the reader to wonder if the facts are as relevant and as valuable as they seem. Amplification of appendices to include all such technical information would have obviated these criticisms.

It seems clear that Chapters 1 to 6 contain the important contribution of the book. In these hundred pages the results of huge masses of statistics are marshaled for a definite purpose, and a logical conclusion is deduced from them, viz.: (a) that climatic pulsations have marked effects upon health, which in turn has much to do with such matters as waves of inebriety, financial crises, and economic and social progress in general; (b) that variability of weather and climate may be a factor of the utmost importance in stimulating a population to the highest achievements, whereas lack of variability may tend to keep a social group at a low level of development.

In the three chapters which close the book, Dr. Huntington, as mentioned above, selects three states as illustrations of "the effect of physical environment upon human progress" (p. 1). The worth of the chapter on Germany is impaired by the fact that it was written while the United States was still actively campaigning against that nation, and therefore shows unfortunate traces of a very natural and pardonable animus. The discussion of Turkey wells up from the author's deep personal experiences and is therefore picturesque and heartfelt; it does not, however, advance the solution of his problem much beyond the point reached in his earlier works on the Near East. The chapter on Rome is open to at least three sweeping adverse criticisms. First, patient and detailed research into the writings of the ancients has failed to reveal any marked "downward sweep" of climate in the Mediterranean region within the period of written record, whereas there is wholly adequate proof that some parts of the basin were in general at least as lacking in moisture in ancient times as now (cf. E. C. Semple: The Ancient Piedmont Route of Northern Mesopotamia, *Geogr. Rev.*, Vol. 8, 1919, pp. 153–179). Furthermore, it is certainly quite unnecessary to struggle to uphold a topheavy climatic hypothesis in order to explain much of Roman history in terms of geography. It is, for instance, clear enough from the experience of farmers on our own Great Plains that a few years of unusually dry weather has been enough to drive them to better-favored lands, and of farmers over the world that the removal of watershed forests in any region which approaches the lower limit of adequate rainfall is likely to result at times in an insufficient water supply in the dependent lowlands. Both these conditions were marked in certain periods of Roman history. It is likewise obvious to every student of historical or political geography that geographic conditions which may be, on the whole, favorable to a population in an early stage of development may come to cramp that population and prevent or retard progress at a subsequent period. Rome stands as a conspicuous example of this principle. Time and again her statesmen were forced to cast about for new means of solving problems arising out of her dynamic activity in a restricted area, and it is little wonder that unrest and decadence are recurring phenomena in Roman history. In the third place, it seems to be generally agreed by students of social science that human motives and human progress or retrogression cannot possibly be explained on any single ground, not even so broad a field as geography as a whole, much less on one or two phases of climate. Dr. Huntington himself warns the reader on this point in his opening pages—but he seems occasionally to forget the warning.

The third (middle) major division of the book undertakes a discussion of prehistoric evolution in terms of climatic changes. That there have been climatic changes in the geological past is certain. There is likewise evidence to show that changes of environmental conditions affect the metabolism of animals. But to attempt to relate the two in our present state of information results in awakening admiration for the audacity of the author and vigorous suspicion of the validity of his findings. It would seem that geologists, biologists, and anthropologists have much spade work to do before geographers can make effective use of their materials in this suggestive and enticing field of research.

In style, in clarity of presentation, and in typographic attractiveness the book approaches the ideal. No worker in the field of human geography can fail to be stimulated by a perusal of it.

D. S. Whittlesey

The Pan-Turanian Problem

M. A. Czaplicka. **The Turks of Central Asia in History and at the Present Day: An Ethnological Inquiry into the Pan-Turanian Problem, and Bibliographical Material Relating to the Early Turks and the Present Turks of Central Asia.** 242 pp.; map, bibliogr., index. The Clarendon Press, Oxford, 1918. 9 x 6 inches.

The subtitle of this book is indicative of its purpose. The question of the political future of Central Asia, a pivotal area in the world's history, becomes of increasing import as to its ancient strategic significance is added increasing significance of its natural riches (see Appendix A for a summary of the resources of Central Asia). Any movement attempting to bring such an area under a single political power perforce seeks justification. Pan-Turanian propaganda has claimed racial unity and the desire for national unity as a basis. On the merits of this claim Miss Czaplicka throws light by an analysis of archeological, historical, and ethnological data of the peoples speaking Turkic languages. Her conclusion is thus expressed: "To speak of the Osmanlis and the Turanian Turks as a racial and cultural unity would be by a stroke of the pen, or by means of a propagandist pamphlet, to wipe away all the invasions, migrations, massacres, and fusions which for twenty centuries have played havoc with that part of the world."

The analysis, occupying only some hundred pages, is of course highly condensed. As an introduction to it one might well use the review—an outline sketch—by H. H. Howorth (*Nature*, 1919, No. 2611, Vol. 104, Nov. 13, pp. 273–274). The second half of the book, another hundred pages, is a bibliography given as "a starting point for further research." Naturally most of the works are in Russian.

THE FREEDOM OF THE SEAS

LOUISE F. BROWN. **The Freedom of the Seas.** xvi and 262 pp.; bibliogr. E. P. Dutton & Co., New York, 1919. $2.00. 7½ x 5 inches.

This is a concise and brilliantly written history of one of the most difficult of international problems. The phrase "freedom of the seas" has been in everybody's mouth during the last five years without any general understanding of what it implies, and without appreciation of the fact that it has been similarly debated on the occasion of every war for the last five hundred years. It was on this issue that we fought for independence in the eighteenth century; that we fought England in 1812; and that we entered the world war in 1917.

Literally interpreted, "freedom of the seas" would mean the complete immunity, from capture or molestation, of private property on the seas at all times. It would also mean that trade might be conducted everywhere without discrimination of nationality or without the impediment of protective tariffs—in this sense implying "free trade." But the term has never been used as connoting complete immunity or comprehensive free trade. It has been employed, almost exclusively, in the form of protest. "When the question has been raised in the past there lay behind it either resentment at inequalities of opportunity in overseas markets or jealousy of the power that controlled the seas" (p. 237).

When Portugal and Spain opened routes to the Indies, it was natural that they should seek to monopolize those routes. The other maritime nations, such as France, England, and Holland, refused, however, to accept this doctrine and fought for "the freedom of the seas" to the extent of their power. Nevertheless, the theory of exclusive or special rights in sea areas has been maintained down to the present time. It was not until 1859 that the tolls imposed by Denmark on ships entering the Baltic Sea were abolished. The United States claimed the Bering Sea as a *mare clausum* in the eighties, though it had protested a similar claim on the part of Russia in 1821. In the late war, the right to monopolize portions of the sea was exercised by the sowing of mines and the proclamation of danger zones.

It is in regard to interference with commerce in time of war that the most bitter and irreconcilable differences have arisen. In such circumstances, belligerents and neutrals have equal interest in the questions of contraband and blockade, of right of search, and of the disposition and destruction of prizes. In the war "neutral commerce has been interrupted to an extent unprecedented in any previous war, and the sea lanes have been made unsafe for travel in a way that makes the days of piracy seem days of gentle usage" (p. 229). The great difficulty has been that agreements on rules to be followed during hostilities have been practically impossible of attainment, since any nation will agree to concede only what it thinks it can yield without weakening itself as a belligerent.

The term "freedom of the seas" has also been used in protest against limitations and restrictions placed upon commerce in times of peace. Thus, "with the development of modern industry, as colonies increased in importance as sources of raw materials and profitable fields of investment, the old desire to guard them for the benefit of nationals grew strong again. Mercantilism revived in new forms. . . . The extension of our navigation laws, which meant our coasting trade monopoly, to our oversea possessions, gave rise to suggestions on the part of Englishmen that it might be desirable to re-enact the British navigation laws" (p. 245).

The position of England on all these questions has been determined by the fact that for centuries she has been the paramount naval power. "The nation that rules the waves today," says Miss Brown, "is the nation that ruled them in the days when France tried to wrest the trident from her. She claims, and with justice, that she has used her power to make and keep the seas free in time of peace. In time of war, she does not hesitate to state, the seas must be closed to her enemies. When, as in the war just ended, her enemies are the enemies of all freedom, criticism is dumb. But it will not remain dumb" (p. 237). It must be evident, indeed, to any reader of this fascinating book that the only reasonable solution of these most difficult questions is international control of the seas through the establishment of a league of nations.

FREDERICK J. TEGGART

Two Modern Regional Geographies of Germany

Willi Ule. **Das Deutsche Reich: Eine geographische Landeskunde.** xi and 546 pp.: maps, diagrs., ills., bibliogr., index. Friedrich Brandstetter, Leipzig, 1915. 9 x 6½ inches.

Gustav Braun. **Deutschland, dargestellt auf Grund eigener Beobachtung, der Karten und der Literatur.** Vol. 1, xi and 383 pp., bibliogr., index; Vol. 2, xv pp., maps, diagrs. Gebrüder Borntraeger, Berlin, 1916. 10 x 6½ inches.

Almost simultaneously there have been published two books on the regional geography of Germany by occupants of the chair of geography at two German universities. It appears immediately that unity of opinion as to the essential content of geography is no nearer among German geographers than it is in this country. The volumes overlap only in a small bit of material that is common to both, and they show that the geographer does not find himself much more seriously limited by his topics than the minister in the pulpit by his text.

The volume by Ule is easy to use. First of all it is so simply arranged that we can refer easily to any natural region or to a factor in the environment. It is useful also, because one can find in it everything that any encyclopedia presents on Germany, and more. It is an attractive book, with nearly a hundred well-selected and adequately described half-tones and various maps in addition. It is readable, for the author writes with spirit and in numerous places achieves rather fine descriptive passages. The book is convenient and valuable for reference purposes.

Ule's "Deutsches Reich," however, is not an important contribution to geographic literature. It breaks no new ground. It is essentially a conscientious compilation without a critical discrimination of material. The author apparently subscribes to the idea that geography is concerned with the special distribution of things. He seems to be without an adequate definition of geography. He is fearful of omitting something that might find a place in a geographic study, and accordingly he has loaded the volume with a great variety of material the relevancy of which is in doubt. Much of its contents is appropriate enough in a Baedeker, but hardly in a geography. The names of churches, public buildings, and points of interest in cities are given at length. The dress of peasants is described in detail. The fauna is listed even down to the mention of fifteen names of butterflies and moths. There is a great deal of this kind of information, commonly presented in a casual manner. Butterflies are mentioned as butterflies, not as part of an ecologic study. Even were they presented in an ecologic setting, should they find a place in a 500-page volume dealing with the conditions of livelihood of 70,000,000 people? The chief criticism of Ule's book is that there has been no sufficiently critical sifting of the material nor an adequate presentation of its geographic bearings.

Braun disclaims the intention of writing a monograph on Germany. He presents rather a collection of sketches of individual regions, with dominant emphasis on the explanation of the staff maps. In this way he simplifies the problem and encourages the more comprehensive and systematic study of detailed maps typical of the several regions. This is the aspiration which the author has for his volume, and he succeeds in it very well. The book is not comprehensive in the monographic sense, but neither is it a fragment. It is an improved application of the idea of explanatory description of land forms, to which much attention is being given on the Continent. The author is primarily a morphologist in viewpoint, but he is enlarging this basis along geographic lines. He still feels constrained to say that the problem of the geographer culminates in the description of the land, but his idea of the land is becoming geographic rather than physiographic. For he adds that the individuality of the land may be determined by physical characteristics or it may be a cultural individuality. "Mitteleuropa" is in his mind a physical environment modified by Germanic culture. There is here a clear, if perhaps excessively nationalistic, realization of the interaction of environment and racial stock. The spirit of Ratzel is astir again, and it is bringing a broadened view to the careful scientific worker of morphological training. His actual objective becomes the study of the evolution of *Kulturlandschaft* out of *Naturlandschaft* by resolving the landscape of today into its components, be they natural or cultural. That is certainly a sufficiently clear and sound aim to merit approbation.

The result is a distinct advance in methods of geographic inquiry. The whole treatment is clear and penetrating, pregnant with thought, not burdened with encyclopedic details. The author is at work constructing generalized images of regions as homes of men. Maps accompany the account, and the reader is directed to follow the statements of the text by further map study. There may be a disproportion of space devoted to the formation of the physical landscape, but therein the author simply retains a limitation that the science itself has not outgrown. He has also narrowed his study of geographic responses in the main to the things shown by the map, that is the relation between topography and economy. This particular theme he has worked out excellently. It would be hard to find more intelligible statements in geographic literature than he presents regarding the location of cities with reference to topography and drainage. There is also a clear recognition of the changing values of the environment with changes in historical conditions.

The general plan is very simple. The first section deals with the form of the natural landscape, the second with the modification of the landscape through its utilization by man, and the third with the present form of landscape (*Landschaftsbild*) for the various regions. One of the most valuable features is the critical bibliography of 53 pages arranged by topics. This bibliography is an impressive annotated record of the large attention and sustained industry that mark the study of regional geography in Germany. The study by Braun may well rank as the most notable contribution to regional geography in current German literature.

C. O. Sauer

Lapland and the Murman Coast

F. H. Butler. **Through Lapland with Skis and Reindeer, with Some Account of Ancient Lapland and the Murman Coast.** xii and 286 pp.; maps, ills., bibliogr. T. Fisher Unwin Ltd., London, 1917. 9 x 6 inches.

The geography and topographic features of Lapland are fairly well known. Carl Vogt, Charles Rabot, and Paul du Chaillu are conspicuous among those who have studied parts of the land. Two-thirds of it was formerly Russian and now is Finnish and Russian. Norway and Sweden divide the other third. The northern section is very mountainous, the rest is largely plain. The author goes there because he knows nothing equal to it for a real health-giving holiday. The air is dry and full of exhilaration; the people are kindly and happy and love their snowy plains even though the sun leaves them for long months. Their wealth is counted in the number of their reindeer, which clothe and largely feed them. In summer, however, the people live mostly on fish, the salmon trout being particularly excellent. Moss is the food of the reindeer, and often they nearly disappear from view in the snow excavations they make to get at their provender.

All Lapps understand one another whether they live in Russian, Finnish, Swedish, or Norwegian territory. Fairs are held in February, when the people exchange their wolf and fox skins, frozen venison, horns, etc., for rice, tobacco, flour, cloth, and other things. Some of the Lapps are rich, and all seem to be comfortable and need no one's commiseration. The author's routes were chiefly in (then) Russian Lapland, and he might, with propriety, have said that there has been reported to be some differentiation between the Lapps of this section and those living in the west.

Cyrus C. Adams

The Physical Geography of West-Central Morocco

P. Russo. **Esquisse du pays Tadla, Maroc occidental.** *La Géographie*, Vol. 32, 1918–1919, No. 8, pp. 570–578. Paris.

The Tadla district in west-central Morocco is of elliptical outline, measuring about 200 kilometers from east to west. It appears to be a moderately depressed basin of synclinal structure, between the Middle Atlas range on the southeast and a series of arid limestone plateaus on the northwest. It is drained to the west-southwest by the Oum-el-Rhia, which, although beset with cascades and rapids farther up and down stream, has an evenly graded course for 125 kilometers or more through the basin plain, in which it is incised to a depth of from 6 to 18 meters; the breadth of the river trench is not stated. The two halves of the basin, each about 25 or 30 kilometers in mid-width, are similarly trenched by lateral streams. On the southeast the basin floor is largely covered with alluvium; here the perennial streams fed from the Middle Atlas range moisten the soil sufficiently to support an agricultural population. On the northwest the plain is more rocky; here the streams disappear in summer, and the population is scanty. The author of this article seems to have attempted an explanatory description of his district, but without full success; first, because the several elements of the landscape are not specifically enough described; second, because the pseudo-learned method is adopted of telling the geological time-scale names of the local rock formations without telling the attitude of their strata; third, because the provincial method is followed of indicating the extent of physiographic features by means of place names that are not found on most maps—for example, the basin plain of Tadla is said to extend "from Bled Imhiouach to Tessaout." The late mention of certain important items is also disadvantageous: the synclinal structure of the district and the entrenchment of the axial river beneath the basin plain are not announced until the last page is reached; they belong on the first page. Altogether, it is difficult to visualize the landscape described.

W. M. Davis

A Vegetation Map of North America

J. W. Harshberger. **[Wall map of the] Vegetation of North America.** Scale, 1:6,170,000. Rand, McNally & Co., Chicago and New York, 1920. $8.00 with wood rod at top and bottom.

The present wall map of the vegetation of North America, prepared by Dr. J. W. Harshberger of the University of Pennsylvania, is suitable for high school and college use and is of interest to all students of plant geography and ecology. The colors and conventions used for the various areas are distinctive, and the mechanical execution of the map is very satisfactory. The author has been successful, in most portions of the map, in mediating between the coarse outlines necessary in a wall map and the accuracy that is necessary in being faithful to the facts. The absence of all political boundaries makes it very difficult, however, to locate specific areas or the lines separating different vegetations.

Twenty-nine types of vegetation are delineated: 8 purely coniferous forest, 4 partially coniferous forest, 4 deciduous forest, 3 sub-tropical and transition types of forest, 2 grassland, 4 desert, and 4 swamp, marsh, and arctic treeless regions. The designations of the various areas are partly in purely botanical terms and partly in terms of the botanical characteristics in conjunction with the geographical location of the areas. In two cases—"Vegetation of San Joaquin and Sacramento Valleys" and "Vegetation and Forests of the Pacific Coast Ranges"—no hint is given as to the character of the vegetations involved. It is not clear what criteria have been used in distinguishing "Tundra and Barren Lands" from "Treeless Regions (above tree limit)." It is doubtful whether the distinguishing features of the "Coniferous Forests of the Northern Rocky Mountains" and the "Coniferous Forests and Vegetation of the Southern Rocky Mountains" are as great as those used in differentiating the other coniferous areas. The distinction involved here is largely a floristic rather than a vegetational one, as is also the case with respect to the characterization of the Edwards Plateau forest of Texas as a "meeting place for plants of Atlantic Coast, Rocky Mountains, and Mexico." The demarcation between the coniferous forests of the southern Rocky Mountains and the sub-temperate hardwood forests of the eastern and western Mexican Cordilleras has been made too far to the north, so far as purely vegetational characteristics are concerned. Much of the area designated as "Deciduous Swamp Forests of the Lower Mississippi Basin" is actually marsh land, occupying a territory of considerable size.

Certain areas of deciduous forests in the highlands of southern Mexico have unfortunately been combined with the very dissimilar vegetations of the eastern and western coasts of Mexico and with the so-called chaparral of southern Texas, and the whole is so designated in the legend as to give the impression that chaparral is synonymous with deciduous forest.

While it is always easy to criticize specific details of a map of this character, it is necessary to bear in mind the very great difficulties involved in its preparation, both with respect to sources of information and the interpretation of very complex plant communities. Viewed as a whole, and with due regard to the difficulties of the task, Professor Harshberger's map is a very creditable piece of work. He has escaped two of the leading pitfalls into which authors of vegetational maps are likely to fall: he has based his areas on purely botanical criteria, without regard to climate, soil, topography, or other causal conditions; and he has used vegetational characteristics in distinguishing his areas, with a minimum of reference to the unrelated floristic features.

Forrest Shreve

Solar Radiation and the Weather

H. H. Clayton. **Variation in Solar Radiation and the Weather.** Introductory note by C. G. Abbot. vi and 53 pp.; maps, diagrs. *Smithsonian Misc. Colls.*, Vol. 71, No. 3. Washington, D. C., 1920.

In the effort to explain the puzzling complexity of changes of climate in the geologic past, variations in the intensity of solar radiation were long ago appealed to as a probable cause. Recently several writers have brought forward a similar explanation in connection with short-period oscillations or fluctuations in various meteorological conditions of the present time. It has, however, remained for Mr. H. H. Clayton, chief of the forecast division of the Argentine Weather Service, to make an intensive study of the relations between solar radiation values and succeeding weather conditions with a view to the improvement and extension of the daily weather forecasts. Mr. Clayton's investigation is therefore distinctly pioneer work, of the greatest practical scientific interest and value. As Dr. C. G. Abbot says in the introduction to the present monograph, the conclusion reached "is of a very revolutionary character and deserves the most careful attention of meteorologists and students of solar physics"

(p. iii), and again, if the conclusions "be true, we stand . . . . on the threshold of a very important research in meteorology" (p. v).

The daily solar measurements made at Calama, Chile, by the Smithsonian Institution, were transmitted to Buenos Aires, at first by mail and then by cable, and were used for forecasting purposes from early December, 1918. By the correlation method, as well as by the method of direct comparison, Mr. Clayton compared all the observations of solar radiation made by the Smithsonian Institution, both at Calama and at Mt. Wilson, with the temperatures and rainfall of Argentina. Further comparisons were also made, in an earlier paper, between the weather in remote parts of the world and the Mt. Wilson observations. It is impossible, in a brief note such as this, to follow Mr. Clayton's very careful and painstaking research in detail. Briefly, his main conclusion is (1) "that if there were no variation in solar radiation the atmospheric motions would establish a stable system with exchanges of air between equator and pole and between ocean and land in which the only variations would be daily and annual changes set in operation by the relative motions of the earth and sun; (2) the existing abnormal changes which we call weather have their origin chiefly, if not entirely, in the variation of solar radiation." During the summer, high values of solar radiation are followed, a few days later, by high temperatures at Buenos Aires, and decreases in solar radiation are followed by rain. In winter, the relation is different, increases of solar intensity being followed three to five days later by rising pressure and cooler weather in Argentina. A detailed study of the lengths of the periods of solar radiation shows that "there is a distinct tendency to form periods around certain lengths," e.g. 3.5 to 3.7 days, 4.9 to 5.3, etc., up to 30 to 34 days. At Buenos Aires the ratio of change of temperature to solar change at the time of maximum solar activity was found, from several years' averages, to be 1.4°C. for each change of 1 per cent of solar radiation. The extreme solar values range about 6 per cent on either side of the mean. Hence departures of about 8.5°C. from the normal at Buenos Aires might result from this cause. Maps are given showing the rainfall on five successive days during which there was a complete daily solar record. On the average, the rainfall follows a solar decrease after about three days in southern Buenos Aires and the Pampa, and after about five days from Corrientes to Tucumán.

The whole investigation is one of the most striking, and is surely one of the most important, which has been brought to the attention of meteorologists in recent years. For about three decades Mr. Clayton has been devoting himself largely to the question of the improvement of daily weather forecasts. With the help of the Smithsonian Institution he has now been able to strike out on a new path, and his conclusions seem destined to revolutionize the whole business of forecasting. Mr. Clayton is not prone to make statements for which he has no good and sufficient scientific basis. Meteorologists, and scientific men generally, may therefore well pay attention to the following: "These studies, it is believed, will permit the prediction of the weather with a fair degree of accuracy for much longer intervals in advance than three days and may perhaps extend them to weeks or years" (p. 52).

R. DeC. Ward

A New Standard Manual of Meteorology

Napier Shaw. **Manual of Meteorology. Part IV: The Relation of the Wind to the Distribution of Barometric Pressure.** xvi and 166 pp., maps, diagrs., ills., index. *M[eterol]. O[ffice Publ. No]. 234*, London, 1919. 12s., 6d. 10 x 7 inches.

This fourth part of what doubtless, when complete, will be for a few years the leading reference book on meteorology is a direct outcome of the war. Quite early in the struggle it began to dawn upon those charged with offensive and defensive operations that some knowledge of the structure of the atmosphere was desirable and might even prove helpful. When evidence began to accumulate that the enemy, not only in his offensive air campaign but also in the execution of land and sea operations, had his meteorologists at work and was gaining much thereby, there came hurried calls upon the British Meteorological Office for data about the winds, at the surface, at moderate elevations, and at the great heights. The naval, military, and air services sent in their questions; and one may well imagine that Sir Napier Shaw and his staff had their hands full. It is a fact that, before the war, surface winds only were considered in gunnery and that upper air conditions were unnoticed. This is only one illustration of the sudden awakening which came in 1914 and 1915.

The present volume was issued in advance of Parts I, II, and III because there was much material at the Meteorological Office which had not heretofore been collected and gathered up in available form. Part I, when it appears, will attempt a general survey of the globe based largely on the work of Teisserenc de Bort and Hildebrandsson. Part II will be perhaps the most vital section, dealing with the thermodynamics of moist air; and Part III will formally set forth the dynamics and kinematics which find their application in the problems discussed in Part IV.

The first broad generalization which Sir Napier Shaw employs is that in the free atmosphere the air obeys very closely the laws of motion under balanced forces, the forces depending upon the earth's spin and a small circle spin of the air. In the upper air, rather than at the surface, we find the true relation between pressure and wind. In fact, if the surface wind be taken as the basis of computation, we cannot express in one equation the relation between wind and pressure gradient, representing the underlying principle upon which Buys Ballot's law depends. Taking it, then, as established that the wind at the 500-meter level satisfies the surface pressure-gradients, the first striking development is that in an anticyclone, the curvature of the isobars being great, the winds near the center must be light; which seems to be true in nature; while on the other hand there is practically no limit to the velocity of the wind in small circles, as near the core of a tropical revolving storm or a tornado.

This explains what Shaw has in mind by motion under balanced forces. Air must be regarded as traveling over long tracks of sea and land with very little change of velocity from hour to hour. Even such an incident as being caught in the ascending current of a rainstorm is after all but a small thing in the life history of an air current. The greater part is made up of such steady motion as we see in clouds journeying long distances with little change in speed. The true function of the pressure distribution is to *steer the air* rather than to speed it or stop it. And having once assumed this "strophic" balance to be true, we may call one factor in the equation for gradient wind "geostrophic," due to the earth's spin, and the other "cyclostrophic."

The first six chapters treat of variations of wind with height; eddy motion and Taylor's theory of diffusion of eddy motion based on the analogous diffusion of heat by conduction; turbulence in relation to gustiness and cloud sheets; föhn and chinook winds; variations of vertical velocities, from pilot-balloon observations; and the structure of the upper layers of the atmosphere.

The other five chapters deal more directly with storm movements. In Chapter 9 we are given maps showing the flow of the air at sea level, 305 meters (1,000 feet), 1524 meters (5,000 feet), 3,048 meters (10,000 feet), 4,572 meters (15,000 feet), and 6,096 meters (20,000 feet) at midday October 19, 1917, that being the date when a very strong wind in the upper air carried a fleet of Zeppelins out of their course and once and for all lost to Germany that supremacy in the air which was counted upon to offset the British supremacy on the sea. This was due to the rapid approach of a second "low," with strong southerly winds, in the rear of another "low" passing eastward. What happened was this. On the western side of the first "low" there was a sudden increase of northerly winds above the two-kilometer level. This persistent wind blowing probably 20 meters per second (45 miles per hour) carried the fleet too far south, into the lines of the enemy.

Chapter 10 deals with curved isobars, i.e. revolving polar caps and bands of air flow that maintain themselves for days. One further type, of greatest interest to forecasters, is rotation around a center in circles of relatively small radius; that is, our familiar cyclones. Evidence of stability in motion of this character is found in all circular storms, from the little "dust devils," lasting but a few minutes, through whirlwinds, tornadoes, typhoons, *baguios*, hurricanes, and cyclones, and up to the revolving cap covering a hemisphere.

A fine example is found in the tropical revolving storm charted by the present reviewer (see Fig. 1 in his article on "Wandering Storms" in this issue), which started on a westerly track towards the Philippine Islands (these storms are called by the Manila Observatory *baguios*), then, recurving, crossed the Pacific Ocean and the North American continent, and ultimately was lost south of Iceland. The whole journey lasted from November 20, 1895, to January 22, 1896. This storm, therefore, went halfway around the world.

Finally, Shaw gives us an analysis of the nature of cyclonic depressions, corrections of anemograms for exposure, and some special cases of cyclonic action in the British Isles. Incidentally it appears that the old notion that variations of temperature at the surface are the initial causes of cyclonic circulation must be scrapped. There are too many known cases of convective heavy rains without consequent circulation.

The book is well printed; the illustrations are clear and properly placed. When we recall that most of the work of preparation must have been done during the stress of war, certainly a large measure of commendation must go to Mr. J. B. Peace, Printer to the University of Cambridge, an old friend and colleague of Sir Napier's.

Alexander McAdie

THE
GEOGRAPHICAL REVIEW

VOL. X AUGUST, 1920 No. 2

PAST AND PRESENT TRADE ROUTES TO THE CANADIAN NORTHWEST

By FREDERICK J. ALCOCK

Geological Survey of Canada

One of the interesting phases of the history of Western Canada, and one which has received but little emphasis, is that of transportation, particularly the changes in both routes and methods which have taken place largely because of the advance of the railroad. In the present period of railroads and lake steamers it is not commonly appreciated how great were the difficulties formerly encountered in carrying on an active trade between points as far distant from each other as Montreal and the upper Peace River or Hudson Bay and the lower Mackenzie, each a distance of over 2,000 miles. The character of the country and the nature of the waterways accentuated the difficulties of transportation and limited the supplies brought into the region to the bare necessities required for the fur trade. The development in the methods of transportation since that time and the consequent changes in trade routes form the subject-matter of the present article.

Historical Summary

From a geographical point of view the history of the Canadian Northwest may be divided into a number of periods which, though they overlap to a greater or less extent, are sufficiently distinct to be helpful in a survey of the larger historical features.

PERIOD OF ISOLATION

The first period may be described as one of isolation, with the country in possession of the Indian hunter and unexplored and undisturbed by the white man. Away to the east lay the French settlements at Quebec and Montreal and the English and Dutch on the Atlantic seaboard; but little did any of these conceive the extent of the continent which lay between them and the western sea.

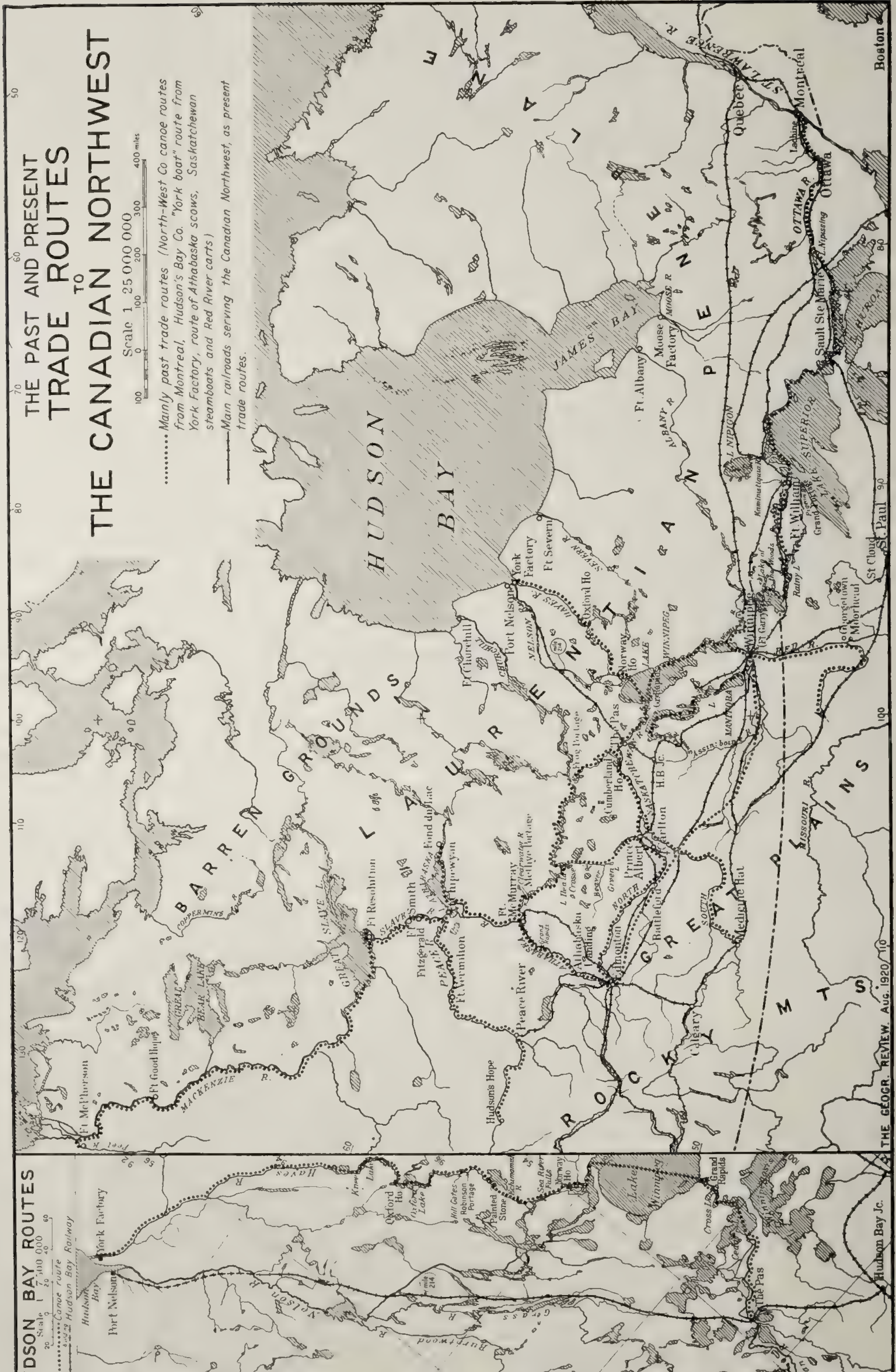
THE PAST AND PRESENT
TRADE ROUTES
TO
THE CANADIAN NORTHWEST
Scale 1 : 25 000 000
100 0 100 200 300 400 miles
Mainly past trade routes (North-West Co canoe routes from Montreal, Hudson's Bay Co. "York boat" route from York Factory, route of Athabaska scows, Saskatchewan steamboats and Red River carts)
Main railroads serving the Canadian Northwest, as present trade routes.
HUDSON BAY
JAMES BAY
BARREN GROUNDS
LAURENTIAN PENEPLANE
GREAT PLAINS
ROCKY MTS
Ft McPherson
Ft Good Hope
MACKENZIE R.
GREAT BEAR LAKE
COPPERMINE
GREAT SLAVE L.
Ft Resolution
Ft Smith
Fitzgerald
PEACE R.
Ft Vermilion
Peace River
Hudsons Hope
Ft Chipewyan
Fond du Lac
ATHABASKA L.
Ft McMurray
Methye Portage
Athabaska Landing
Edmonton
Battleford
Prince Albert
Carlton
Cumberland Ho
The Pas
Frog Portage
H.B. Jc.
NORTH SASKATCHEWAN R.
SOUTH SASKATCHEWAN R.
Calgary
Medicine Hat
MISSOURI R.
Assiniboia
MANITOBA
Winnipeg
Ft Garry
RED R.
Georgetown
Moorhead
St Cloud
St Paul
Rainy L.
Lake of the Woods
Ft William
Grand Portage
LAKE SUPERIOR
Kaministiquia
L. NIPIGON
Sault Ste Marie
HURON
L. Nipissing
OTTAWA R.
Ottawa
Lachine
Montreal
Quebec
ST LAWRENCE R.
Boston
Ft Albany
ALBANY R.
Moose Factory
MOOSE R.
Ft Severn
SEVERN R.
York Factory
Port Nelson
Oxford Ho
Norway Ho
HAYES R.
NELSON R.
LAKE WINNIPEG
Ft Churchill
CHURCHILL R.
THE GEOGR. REVIEW, Aug. 1920
HUDSON BAY ROUTES
Scale 1 : 5 000 000
Canoe route
Hudson Bay Railway
Hudson Bay
York Factory
Port Nelson
Hayes R
Nelson R
Knee Lake
Oxford Ho
Oxford Lake
Hill Gates
Robinson Portage
Painted Stone
Echimamish R
Sea River Falls
Norway Ho
Lake Winnipeg
Grand Rapids
Cross L.
Cedar L.
The Pas
Hudson Bay Jc.
Saskatchewan R
Grass R
Burntwood R

FIG. 1

The Trader Reaches the Border

The second period is that in which the trader reaches the border of the great interior country. To the white man the resources of the country were twofold. Its broad extent, its soil and timber, suggested possibilities for the founding of new colonies. The immediate value, however, which first lured him was its fur trade. Contact was made at two points. The French from Montreal and Quebec advanced westward following the natural waterways and finally reached Lake Winnipeg. They ascended the Red River and in 1742 reached the Missouri. They also discovered Lake Manitoba and explored the Saskatchewan River to the forks. Thus the border was reached from the south.

Contact was also made in the northeast on the shores of Hudson Bay. In the year 1670 a charter was granted by King Charles II to "The Governor and Company of Adventurers of England Trading into Hudson's Bay" giving them the monopoly of the trade, fisheries, minerals, etc., of all the lands bordering on Hudson Bay, in return for which the company was to govern and defend the territory. Trading posts were established first on the coasts of James Bay and then on the western coast of Hudson Bay. These posts were all located at the mouths of important rivers which offered communication with the interior. The Indians were induced to come to the forts to trade, and, as long as their fur-loaded brigades came annually to the posts, no attempts were made by the English traders to penetrate inland. The long trips which the natives made to the coast forts showed how great was their desire for the company's goods. For example, as late as 1782 the Chipewyan Indians of Lake Athabaska sent or carried their furs overland to Fort Churchill at the mouth of the Churchill River, a journey which occupied five or six months and in which they were often reduced to the greatest extremities of hunger and fatigue owing to the scarcity of game in the region which they crossed.

The Trader Penetrates Inland

A new period began when it became necessary for the trader to penetrate inland. After the transfer of Canada to the British in 1763 a great influx of English-speaking merchants, many of them of Scottish descent, took place to Montreal. These soon found the fur trade of the interior to be very profitable, and it was not long before their *voyageurs* had rediscovered the old French canoe routes and penetrated even farther into the Northwest. Their trading operations with the Indians were so successful that they resulted in the obtaining of much of the fur that ordinarily went to the Hudson's Bay Company. This stopping of the flow of furs to their forts aroused the English company to the fact that, if they were to retain the trade, it was necessary to establish inland posts; accordingly, in 1774, Samuel Hearne, famous for his overland voyage from Fort Churchill to the Coppermine River in 1769–1770, established Cumberland House on Sturgeon Lake north of the Saskatchewan River, and the contest between the Scotch merchants of Mon-

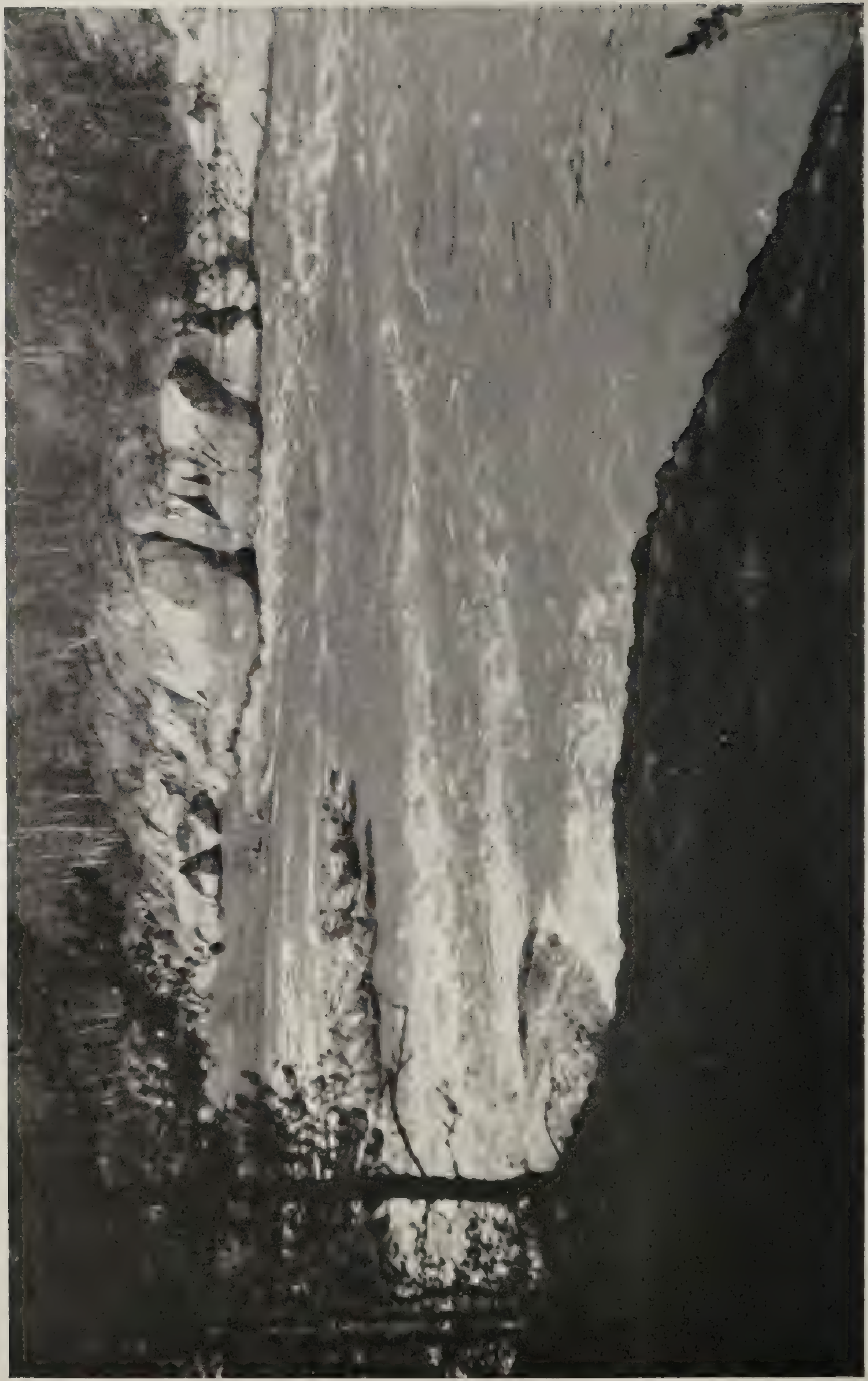

Fig. 2—Running a rapid on "The Elbow," one of the branches of the Nelson River below Cross Lake. (Photo by L. C. Thompson. The illustrations in this article are chiefly from official photographs of the Geological Survey of Canada.)

treal and the English merchants of the Hudson's Bay Company was actively begun. The union of the Montreal merchants in the year 1784 into one North-West Company intensified the competition, for there were now two strong organizations each striving for control.

This period of rivalry was also an era of important exploration, since it was realized that the posts established nearest the hunting grounds received the trade. Some of the more important features of this may briefly be summarized. Under the North-West Company the old Kaministiquia route from Lake Superior to the Winnipeg River was rediscovered, and the exploration of the Red, Assiniboine, and Saskatchewan Rivers was accomplished. A new route from Lake Nipigon to the Winnipeg River was found, and also the route from the Saskatchewan to the Churchill River by way of Frog Portage and from there the route by way of Methye Portage to the Athabaska River. Lake Athabaska and the Peace River were discovered, and in 1789 Alexander Mackenzie, a North-West partner, followed the river which bears his name to the Arctic Ocean. In 1793, on a second journey, he reached the Pacific Ocean from the headwaters of the Peace, the first white man to cross the continent. Of other exploits of the North-West explorers may be mentioned the discovery of several important passes through the Rocky Mountains and the descent of the Fraser and Columbia Rivers to the ocean.

To the Hudson's Bay Company are due the exploration of the Nelson and Hayes Rivers and of the Churchill as far as Frog Portage and the discovery of Great Bear and Great Slave Lakes and the Coppermine River by Samuel Hearne. The Saskatchewan was also followed to the upper waters of both of its branches.

The rivalry led to many conflicts in the wilderness between the men of the two companies. Those employed by the North-West Company were largely French Canadians, and the company especially sought those who were eager for physical conflicts with their rivals. The men of the Hudson's Bay Company, on the other hand, were mainly Orkney Islanders, less quarrelsome but marked by great loyalty to their company.

The Settler Reaches the Border

The next stage in the history of the region may be described as that in which the settler reaches the border. In 1811 Lord Selkirk of the Hudson's Bay Company sent out a contingent of settlers from Scotland, and in 1812 they arrived at the Red River. In 1815 another band arrived. A new era had begun in which it was realized that the country had a source of wealth other than furs. The arrival of settlers was, however, not at all welcome to the traders of the North-West Company, and the climax of the struggle between the two rival organizations was reached on June 19, 1816, when Governor Semple of the Red River colony and twenty of his men were killed at Seven Oaks by North-Westers. The final result was a union of the two companies in 1821 under the name of the Hudson's Bay Company.

After the union the operations of the company attained their maximum extent, reaching down along the North-West Company's routes into Oregon and later into northern British Columbia and the Yukon.

THE SETTLER DEVELOPS THE PLAINS

The final period, which may be considered to extend to the present, is that marked by the westward advance of the settlers as they spread out over the Great Plains. Settlements grew up first around the old trading posts of the plains, then along the trails and rivers, and finally along the railroad as rapidly as it advanced. Henceforth trade with the settlers was to take precedence over the fur trade on the prairies. North of the settled belt, however, in the regions where agriculture is impossible, the fur trade maintains its old importance. On the Saskatchewan trade in connection with a new mineral interest has recently developed, and Cumberland House, instead of being a gateway to the fur wealth of the Athabaska region, has become the point of entrance to a new copper and gold belt.

The latter part of this period of settlement is chiefly marked by railroad development. Since 1879 the railroad has extended out over the Great Plains in all directions, and wherever it has gone it has caused the abandonment of the pioneer methods of transportation.

The Route from Montreal

As already stated, the early important posts of the Hudson's Bay Company were on the coast of Hudson Bay, while the headquarters of the North-West Company were at Montreal. The former, therefore, had a much shorter distance to transport their trading supplies than the merchants of Montreal. They also brought in a superior quality of goods, which the Indians soon recognized, and in addition they established a reputation for fair dealing, both of which tended to give them a decided advantage over their North-West rivals. The latter, however, had certain considerations on their side in the contest. From Lake Winnipeg westward the routes followed by the rival traders were practically identical, and the North-Westers in their swift canoes usually had little difficulty in outracing the slower boats of the traders from the bay. The French Canadians, besides being expert canoemen, were also quick to learn the language of the Indians and to make friends with them, although they never succeeded in inspiring the respect which the English company's traders commanded.

Two water routes could be followed from Montreal to Lake Superior. One led from the St. Lawrence River by way of Lakes Ontario and Erie to Lake Huron. The one more commonly used by the fur traders, however, was by way of the Ottawa River (see map, Fig. 1). The half-way post between Montreal and the Northwest was first at Grand Portage on Lake Superior, near the mouth of the Pigeon River, but when this became American territory a new route was sought by the North-West Company. One was found by way of Lake Nipigon, but later a better route was discovered and a new headquarters post, named Fort William, was accordingly built at the mouth of the Kaministiquia.

Method of Transportation

The supplies that were to be distributed throughout the Northwest as far as the Athabaska country were carried from Montreal in canoe brigades. The canoe commonly used was the large birch-bark "rabascaw" with high, rounded ends and about 33 feet long and 4½ feet wide, or, as the canoemen would describe it, the "five-and-a-half fathom variety." Its cargo consisted of 1,000 pounds of provisions and 60 pieces of merchandise for trade, each weighing from 90 to 100 pounds. Including the weight of the canoemen, of whom there were eight to a canoe, and their personal bags weighing 40 pounds each, the load was therefore about four tons. As the operations of the traders widened, the brigades steadily increased in size. The early Montreal traders sent out brigades of three or four large canoes, often accompanied by smaller ones. Around 1800 the squadron that left Montreal in the spring usually consisted of about thirty, divided into three brigades. Later, when the North-West Company was at the height of its power, brigades numbering from ninety to one hundred large canoes would gather at Lachine immediately above Montreal for their journey to Fort

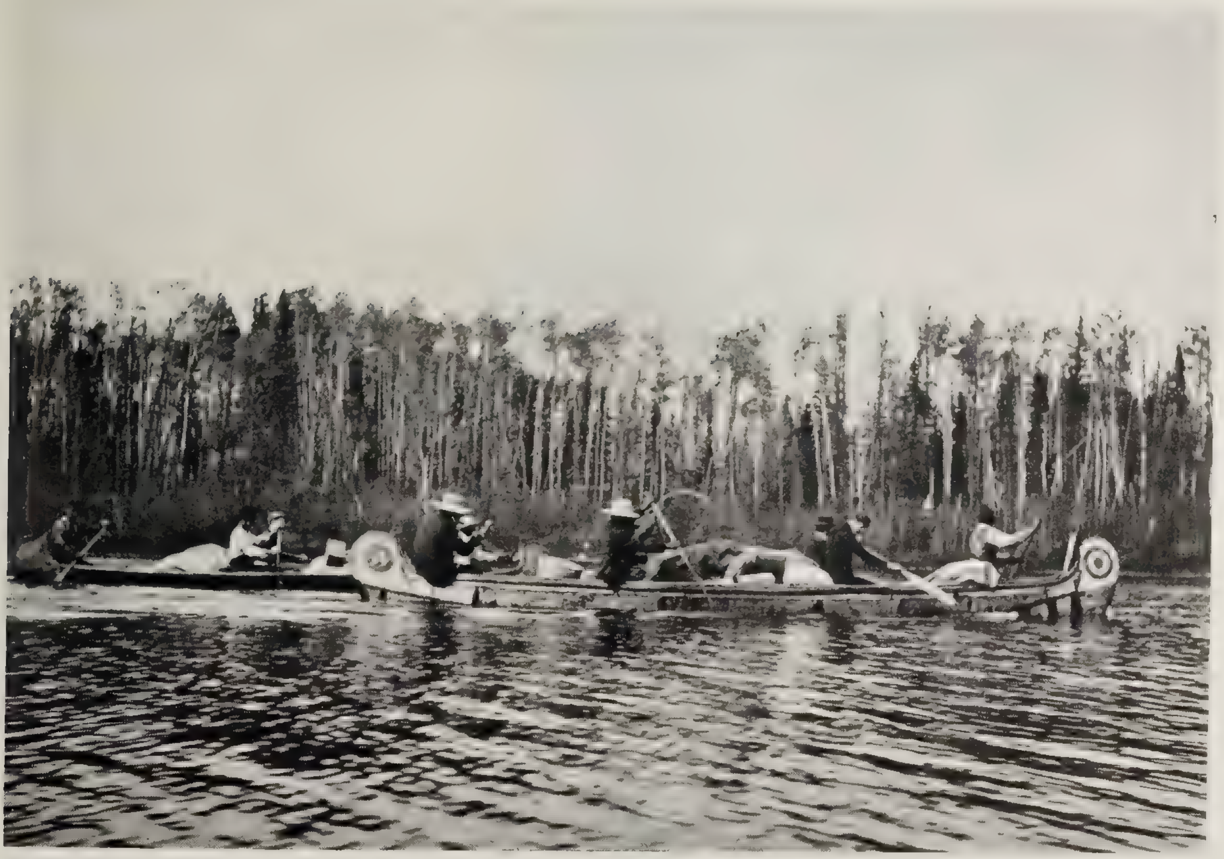

FIG. 3—A bark canoe on the Missinaibi River, 1901. It was this type of canoe that was used by the French-Canadian *voyageurs* of the North-West Company. (Photo by D. B. Dowling.)

William. With these brigades would be thirty or forty guides and usually a partner of the company in command, traveling in state in a smaller, swift canoe.

MONTREAL TO FORT WILLIAM

From Lachine the canoes proceeded up the Ottawa River, past the Long Sault Rapid—the Chaudière Falls at the site of the present city of Ottawa—and on over thirty-six other portages. From the Mattawa, a tributary of the Ottawa, the divide was crossed to Lake Nipissing, and then the route lay downstream to Lake Huron. There the brigades would sweep along the north shore, in fair weather traveling from three o'clock in the morning until late in the evening; then up the St. Mary's River, past the Sault Rapid and into Lake Superior; skirting the north shore of the lake, they hurried on to Fort William. There a couple of weeks were usually spent in preparing for the return journey, and then the canoes, loaded with furs collected from the West, started on their return journey to Montreal.

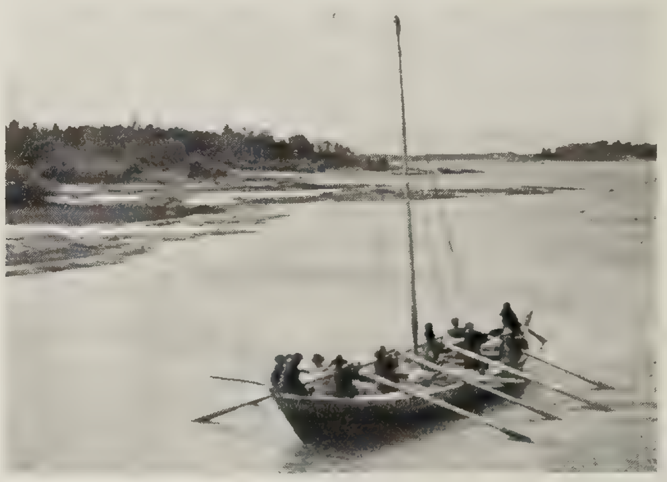

FIG. 4

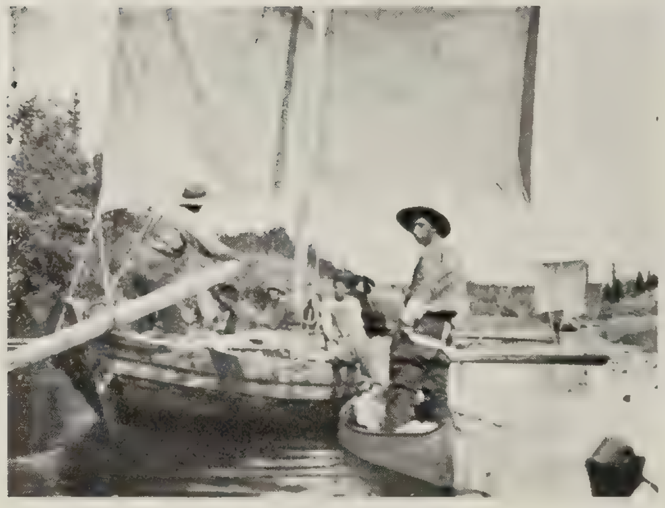

FIG. 5

FIG. 4—A York boat.

FIG. 5—York boats on the Echimamish, a stream connecting the Hayes and Nelson Rivers drainage. (Photos by E. L. Bruce.)

FORT WILLIAM TO LAKE ATHABASKA

From Fort William new brigades starting in August carried the trading supplies to the far distant points of the West. Smaller canoes about twenty-four feet in length, easier to portage than the big canoes used on Lake Superior, were used in these Western brigades. The route led up the Kaministiquia River to the height of land and thence downstream to Rainy Lake. On every long portage was a cabin where food and drink could be purchased by the *voyageurs*. On Rainy Lake the fur brigades from Athabaska were often met by the *voyageurs* from Montreal, since it was usually too long a journey for the former to go as far as Fort William and to return in the same season. On the lakes the brigades frequently had the opportunity to take advantage of a fair wind. Canoes would then be lashed together, sails hoisted, and the canoemen could rest from their paddles. Often over one hundred canoes would thus be seen together.

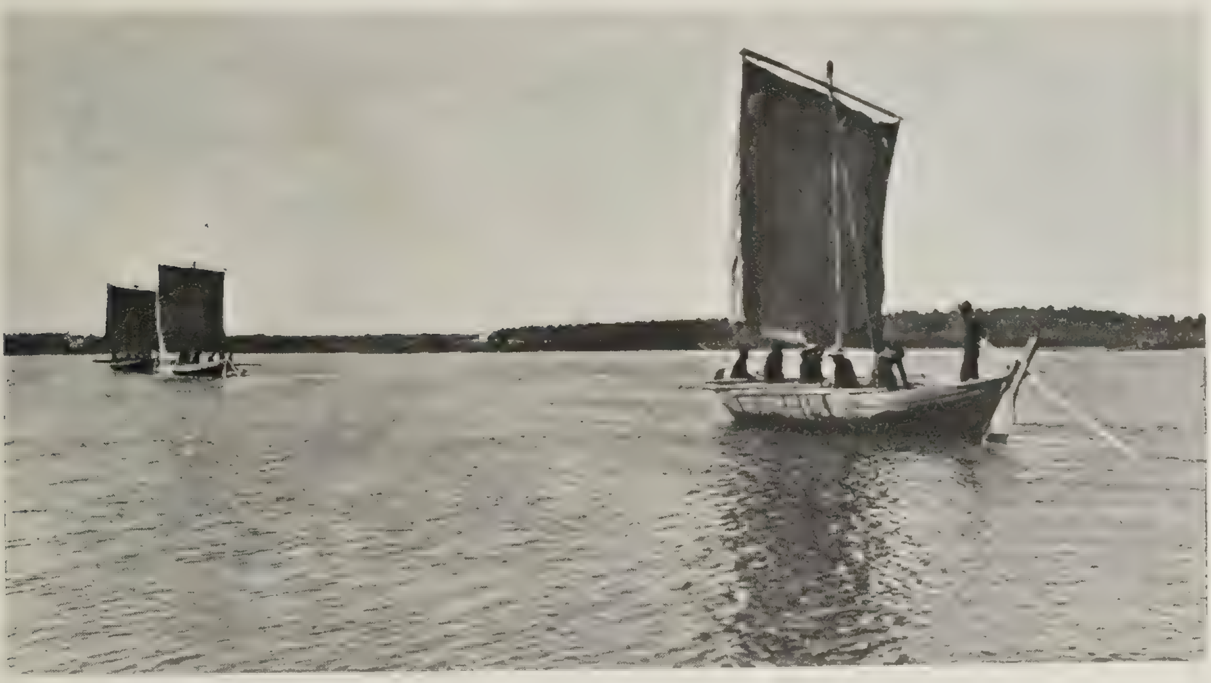

FIG. 6—York boats under sail, Cross Lake. The York boat has been the usual means of conveyance between Hudson Bay (York Factory) and Lake Winnipeg (Norway House). (Photo by M. McIvor.)

From the Lake of the Woods the brigades followed down the turbulent waters of the Winnipeg River, a stream with so many falls and rapids that it was called by the *voyageurs* the White, or Foaming, River. Arrived at the southern end of Lake Winnipeg, the brigades separated. Some would cross to the mouth of the Red River and ascend it to the mouth of the Assiniboine. Here a further division would take place, some ascending the Red River with supplies for the natives as far as the Missouri River; others would ascend the Assiniboine for trade on Lake Manitoba and the Swan River country. The northern brigades for the Saskatchewan and Athabaska, however, proceeded from the mouth of the Winnipeg River along the eastern shore of Lake Winnipeg, and then across its northern end to Grand Rapids at the mouth of the Saskatchewan River. Above what is now the

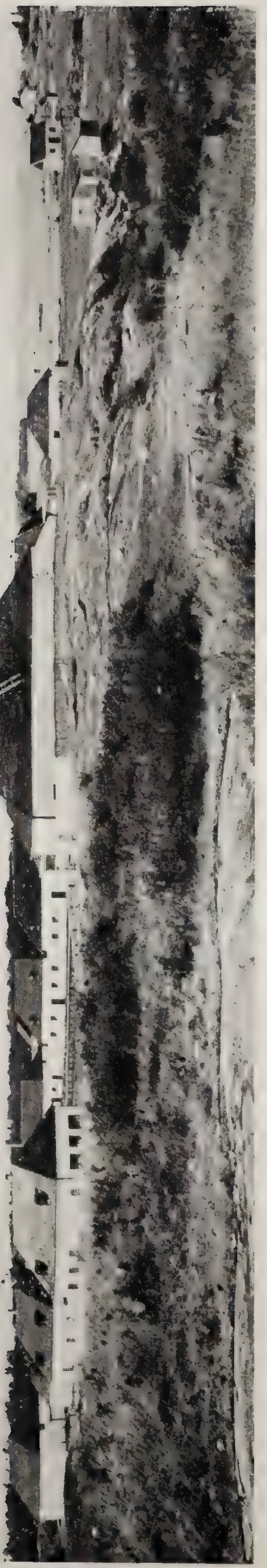

FIG. 7—Norway House, a Hudson's Bay Company's post on the eastern branch of the Nelson River near the outlet of Lake Winnipeg. Norway House was long one of the company's most important posts. (Photo, 1919, by F. J Alcock)

town of The Pas on the Saskatchewan, a separation took place. Some of the brigades proceeded up the two branches of the Saskatchewan. Those bound for Athabaska, however, left the Saskatchewan near Cumberland House, crossed Cumberland and Sturgeon Lakes, and ascended the Sturgeonweir River to Frog Portage, where a portage of four hundred yards took them into the waters of the Churchill River. The Churchill was then ascended through Lake Isle à la Crosse to its headwaters in Lake la Loche.

Here, between Lake la Loche and the waters of the Athabaska basin, lay the famous long portage known as Methye Portage, or Portage la Loche. Its length is 12¼ miles, and for a period of one hundred years it formed the most serious obstacle in the transportation to and from the Athabaska country. For most of its distance the trail crosses a level sandy surface covered with pine and spruce. About a mile from the northwestern end, however, is an abrupt rise, about 600 feet high, which consists of a series of eight steep hills whose ascent and descent for the *voyageurs* carrying packs or canoes proved equally difficult. From the summit of the portage the view overlooking the valley of the Clearwater River has been described as one of the most beautiful scenes on the continent. Once across the long portage the brigades had a downstream route along the Clearwater and Athabaska Rivers to Fort Chipewyan on Lake Athabaska, the important rendezvous and distributing point for the Athabaska-Mackenzie region.

The Route from Hudson Bay

The main route of the Hudson's Bay Company by which supplies and merchandise were taken from the coast to

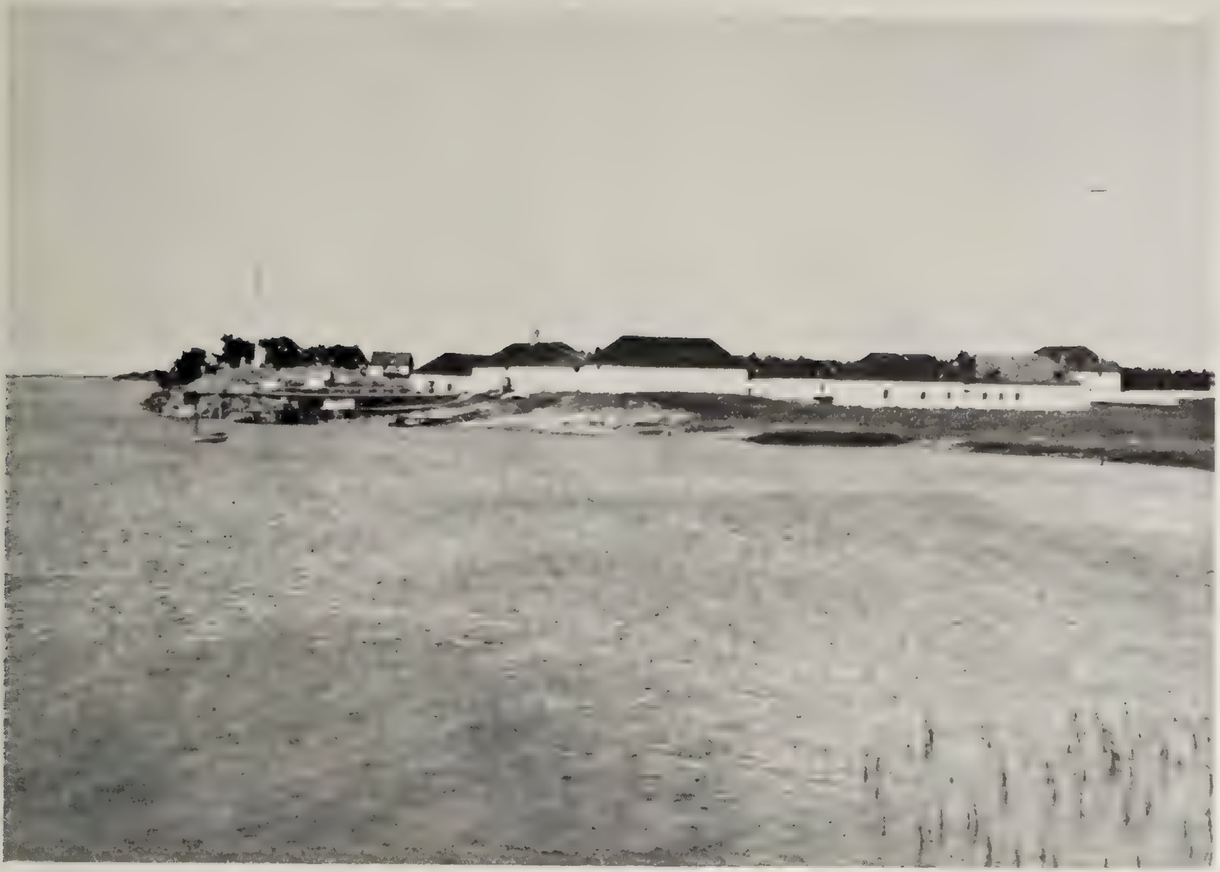

Fig. 8

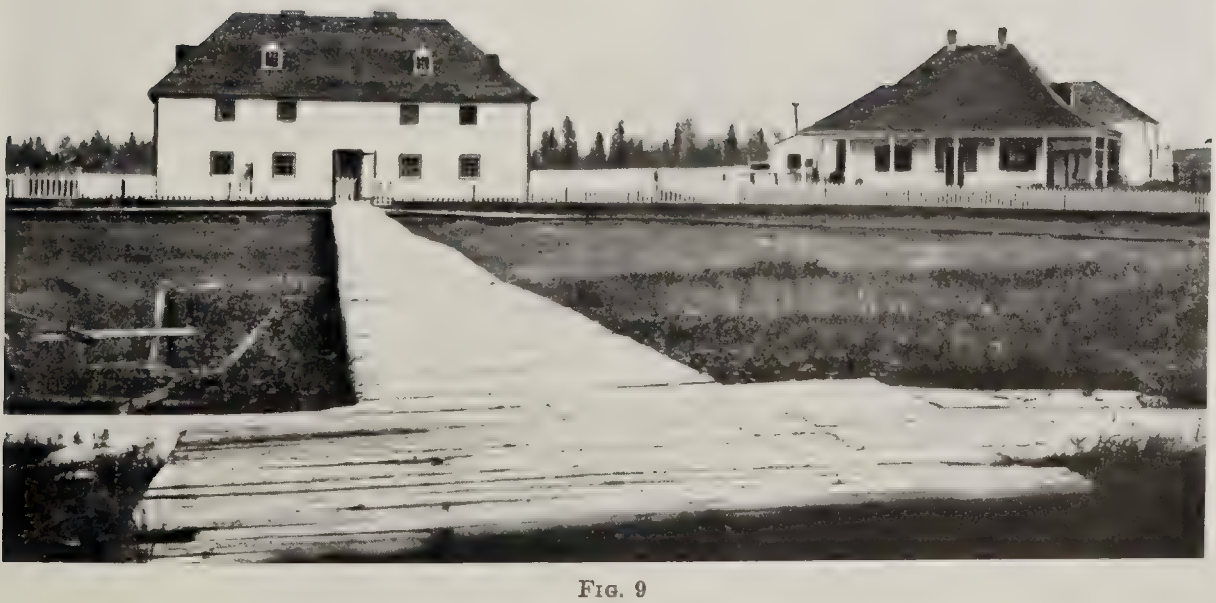

Fig. 9

Fig. 8—Norway House. (Photo by F. J. Alcock.)
Fig. 9—Inside the quadrangle, Norway House. (Photo by E. L. Bruce.)

their inland posts as far as the lower Mackenzie River was for nearly one hundred years the Hayes River. Other rivers, such as the Churchill, the Albany, and the Moose, were important in supplying large areas, but the main highway for the West began at York Factory.

YORK FACTORY

The history of York Factory may be said to have begun in 1682, when two French-Canadian adventurers, Radisson and Groseilliers, who earlier had been largely responsible for the formation of the Hudson's Bay Company and had led its first expeditions to the bay, reached the Hayes River and built Fort Bourbon on its northwestern bank. In 1684 Radisson re-entered the service of the Hudson's Bay Company and took possession of Fort Bourbon, renaming it York. In 1694 York was captured by the French under the command of Pierre le Moyne d'Iberville and was retained by them for two years, when it was recaptured by the British. In 1697 d'Iberville, after defeating a British fleet in the bay, again captured York, and again it became Fort Bourbon. In 1713 by the Treaty of Utrecht it was given back to the British and occupied by them until 1782, when it was once more captured and burnt by the French. In the following year a new fort was erected. In 1792 new buildings situated a mile upstream on the present site of York Factory were completed.

York long remained the Hudson's Bay Company's most important post. Once a year the company's ship arrived from England with provisions and articles for trade, and it was a rule to keep at least two years' supplies for all the posts of the interior in the large warehouses to guard against all contingencies. Part of the merchandise received from England came packed in bundles suitable for the trip inland: for example, bales of blankets and cloths, kegs of gunpowder of 66⅔ pounds weight each; chests of tea of 50 and 100 pounds weight; cases of soap; cases of Indian flintlock guns and rolls of tobacco, etc. Other articles were repacked, however, at York. In this repacking care was taken not to place all of the articles of one kind intended for a particular post in the same bale, so that, should any pack be found missing, the loss for a particular fort would not be total in respect to any one necessity. Similarly, in bringing fur out from the interior to York each bale was made up of pelts of various kinds in order not to run the risk of losing a pack which might consist entirely of the more costly furs. Besides the materials brought out from England, many articles were manufactured at York for the trade inland. Blacksmiths and tinsmiths made such articles as Indian axes, ice chisels, fish spears, nails, tin kettles, cups and bowls in nests, and many other articles. York Factory to a certain extent was a real factory.

METHOD OF TRANSPORTATION

The trip inland was made, not with canoes like the North-Westers, but in pointed, flat-bottomed vessels about 35 feet long, known as York boats. Each boat was manned by a crew of eight or ten and could carry about five tons of cargo. In the early days the crews consisted of Orkney men, but later when the brigades increased in number it became necessary to employ Cree Indian crews, and the problem of getting sufficient men to man the boats was often acute. On lakes and smooth streams the boats could take off a fair breeze by hoisting a large square sail; when there was no such favorable wind they were rowed by eight oars and steered by a long sweep at the stern. Going upstream the vessels were commonly tracked with a long towing line by the crew walking along the bank. The portages around falls and rapids were cut into regular roads, and smooth poles were laid down every few feet, over which the crews hauled their boats. The boats traveled in brigades composed of four or five boats, and, though each crew carried their own cargo across the portage, they usually united to take the boats across. On portages where the boats had to be pulled up over a hill a windlass was commonly stationed at the summit. The rivalry between the crews of the different boats led to a much greater amount of speed and

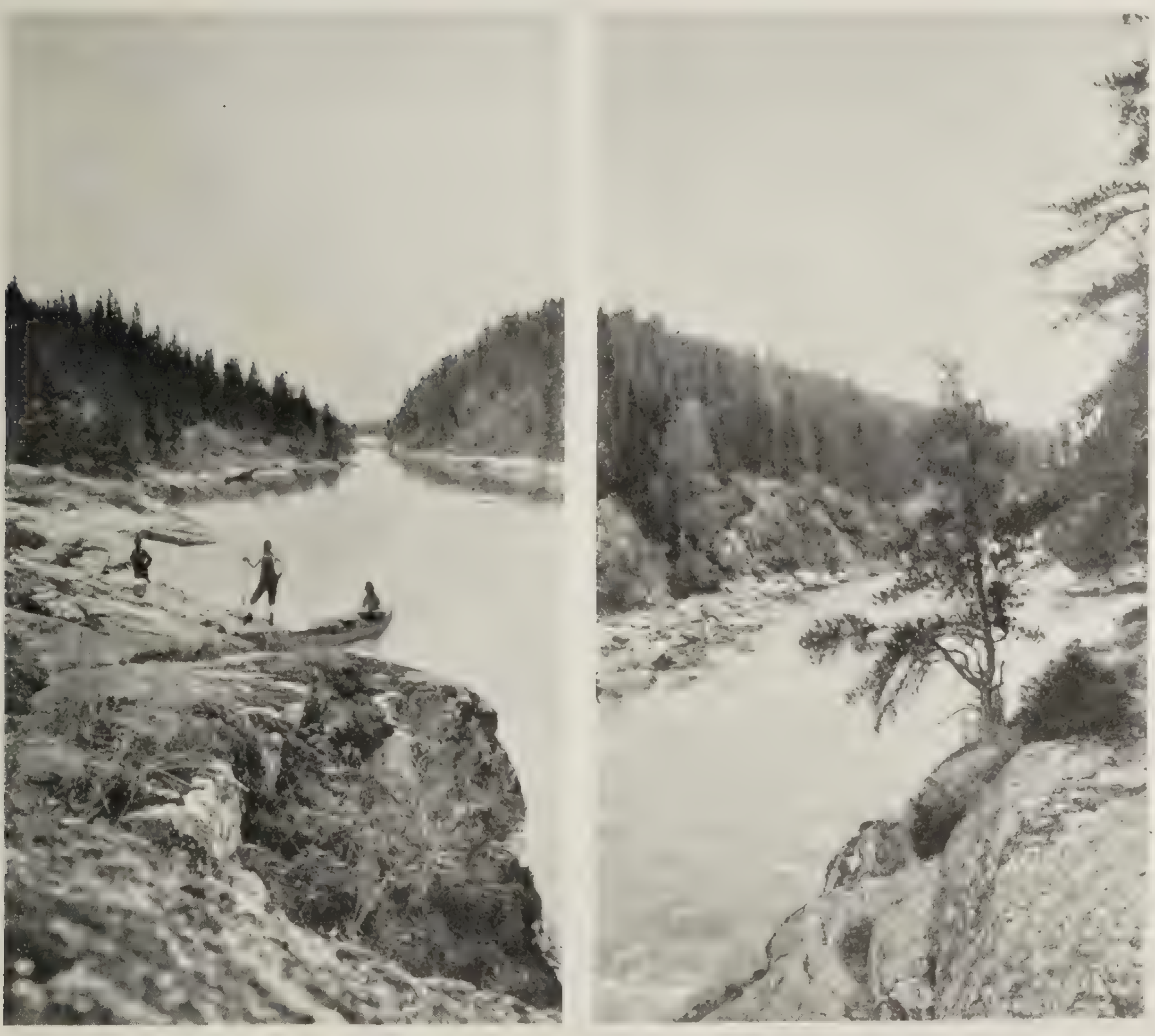

Fig. 10

Fig. 11

Figs. 10–11—Two views of the gorge known as Hill Gates on the Hayes River above Oxford Lake. (Photos by E. L. Bruce.)

effort than when a boat was traveling alone. The racing sometimes had a practical significance. In June, 1919, while the writer was making a portage at Sea River Falls on his way down the Nelson River, he had the opportunity of seeing an example of this in a race between five empty York boats which were ascending the river. The boats rowed up and took their positions behind one another at a rock in the rapids, and the crews of all five worked in getting the first up over the fall. When this was done its crew immediately got in and rowed on. The second proceeded likewise. When the turn for the third came, however, there were not enough men to get it over, and the last three boats had therefore to row down to a side channel where the ascent was more gradual and required longer work.

The rivalry was not only between the separate boat crews but extended down to the individual members of the crews. A common load across a portage consisted of two pieces, but great pride was taken in carrying three or even more at a single trip and in crossing either way on the run. The attitude adopted was that the quicker the disagreeable work was finished the better. Spells of hard work alternating with periods of rest was the type of work most acceptable to the Indian, and the traders soon found they could accomplish more by adopting this method. In tracking, the boat crew was commonly divided into two parts, one of which rested on board, while the other worked, with a change every half hour. They frequently adopted the same plan in rowing. When there was a head wind on a lake they calmly waited for more favorable weather, and then, when it arrived, would travel early and late at high pressure to make up for lost time.

York Factory to Norway House

The first part of the journey from York up the Hayes meant tracking for the most part, and farther on, where the stream became swifter and rapids numerous, besides tracking it became necessary in places to row, pole, push, and warp. On Knee and Oxford Lakes there was often an opportunity to sail, which meant a rest and sleep for the hard-worked crews. Above Oxford Lake there was more upstream work. At one place, known as Hill Gates, a gorge three-quarters of a mile in length is so narrow that the York boats cannot at certain points use their oars for rowing. Farther on at Robinson Portage boats and cargoes have to be taken overland for a distance of about a mile. Fifteen miles above Robinson Portage the route leads up a narrow stream known as the Echimamish, a Cree name, meaning a river which flows both ways. It is a narrow shallow creek winding through a grassy marsh, and sufficient water for boat travel is kept in it by dams. These dams were originally the work of beaver, but after these were exterminated, the dams were kept in repair by the company. At what is known as the Painted Stone a short portage leads across the divide to the part of the Echimamish which flows westward to the Nelson River. Arrived on the Nelson it was upstream once more to Norway House on the eastern branch of the Nelson near the outlet of Lake Winnipeg.

NORWAY HOUSE TO METHYE PORTAGE

Norway House long occupied a position among the posts of the company second in importance only to York Factory. The goods received from England in the summer were repacked at York during the succeeding winter. In the following summer these goods were freighted to Norway House and stored there for the winter to be carried in the succeeding freighting season to Methye Portage. This journey to the divide between the Hudson Bay and Mackenzie River slopes was also made by York boat brigades manned by Indian crews. The route led across the northern end of Lake Winnipeg to the mouth of the Saskatchewan River. Here were encountered the Grand Rapids of the Saskatchewan River, approximately three miles in length. A portage a little over a mile long leads past the most troublesome part of the rapid. The boats were commonly tracked with half a load up the rapid to the foot of the portage, unloaded, run down again, and then tracked up once more with the remainder of the load. The cargoes were then portaged, and the boats, each with about 1,300 pounds of cargo left in, were pulled up the southern side of the rapid to the upper end of the portage. When the brigades were small and poorly manned they frequently took boats as well as cargoes over the portage. A tramway 3½ miles in length was eventually built in 1871 to portage the cargoes past the entire length of the rapid. Above the expansions west of Grand Rapids known as Cross and

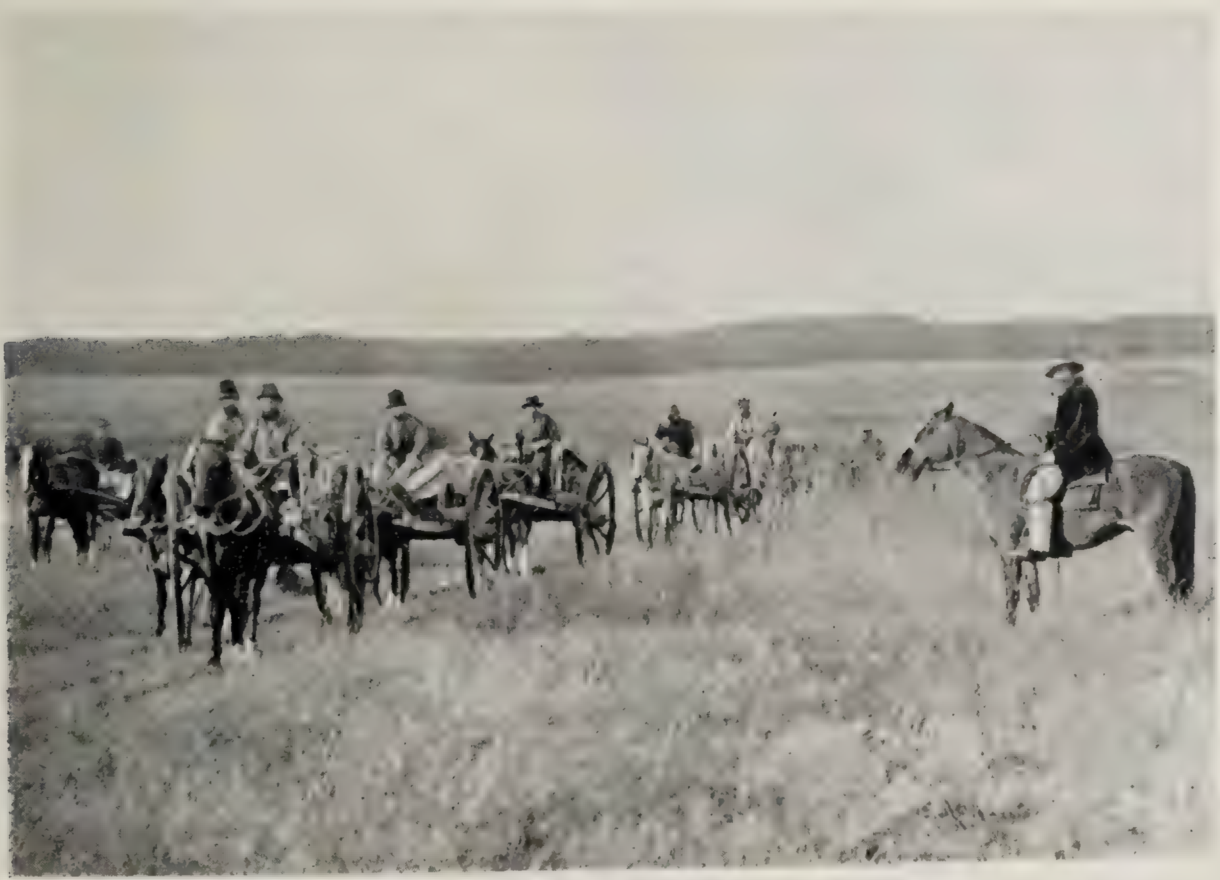
FIG. 12—A Red River cart brigade. The Red River carts were used in the pre-railroad days for transportation across the Great Plains from Fort Garry (Winnipeg) to Battleford and Edmonton. (Photo by George M. Dawson.)

Cedar Lakes, the current of the Saskatchewan is strong and the boats were tracked most of the way to Cumberland House. From here the route followed was the same as that employed by the North-West canoe brigades, up the Sturgeonweir, across Frog Portage to the Churchill River, and on to the long Methye Portage. For a time the York boats were dragged overland across the long portage, but it was eventually arranged that two brigades of boats should operate, one from Fort Chipewyan on Lake Athabaska to Methye Portage and one between Methye Portage and Norway House. This eliminated the arduous work of dragging the heavy boats such a distance but, on the other hand, necessitated careful planning on the part of the officials at Norway House in order that the two brigades should meet at the portage without a long wait by either party. Sometimes it was impossible to restrain the Indian crews from starting back home with empty boats without waiting for the arrival of the fur cargoes from the Athabaska region.

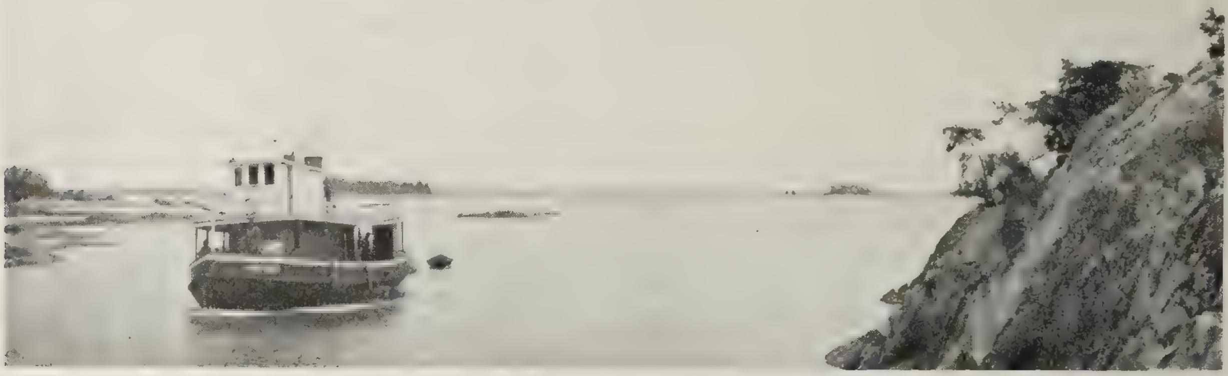

Fig. 13—The tug *Victor*, plying between Warrens Landing, at the northern end of Lake Winnipeg, and Norway House. Steamers run weekly from June to early October from Selkirk on the Red River to Warrens Landing.

York Boat Freighting

York boat transportation reached its maximum when the supplies for the Red River colony as well as for the Western trading posts were brought in by the route from Hudson Bay. In the year 1858, 167 boats passed Norway House on their way to York Factory to return with supplies for the Red River settlements. These belonged to private merchants and traders as well as to the Hudson's Bay Company.

Freight rates under the York boat transport system were necessarily high. The load of a boat consisted of at least seventy bundles, or "pieces," each piece of 90 pounds weight. From York Factory to Norway House, the freight charge per piece was $3.50; from York Factory to the Red River settlement, $4.50; from York Factory to Edmonton, $7.50; to Athabaska, $10.00; and to the Mackenzie River, $12.50.

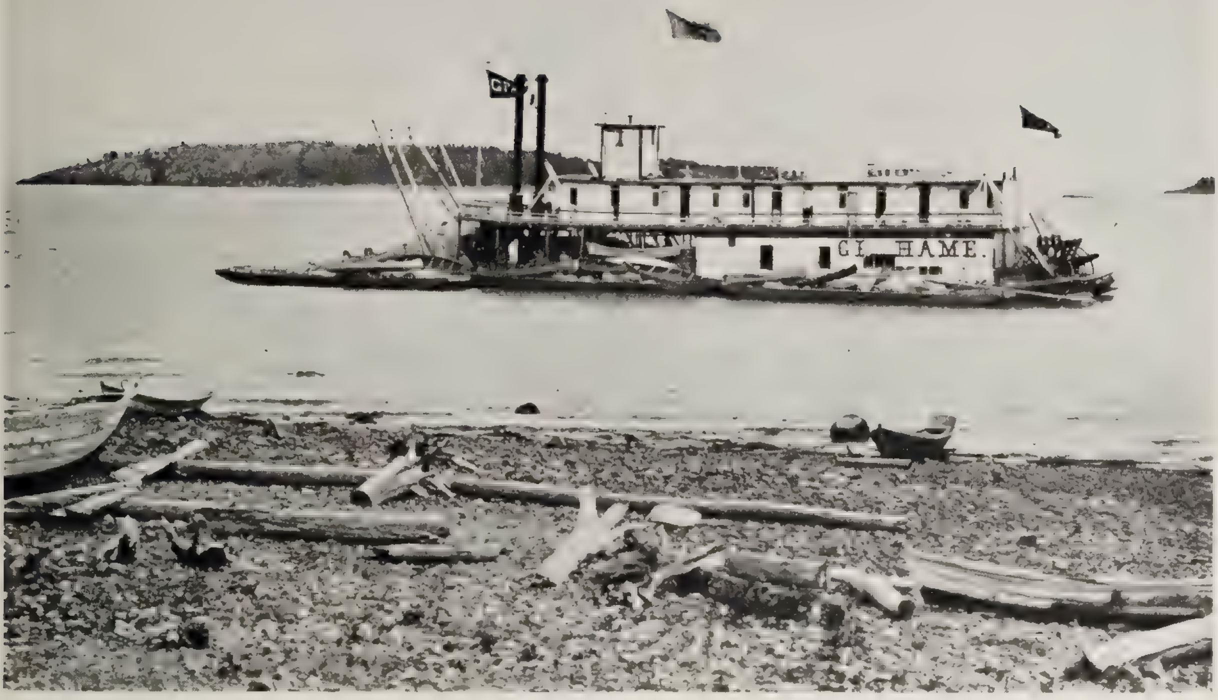

FIG. 14

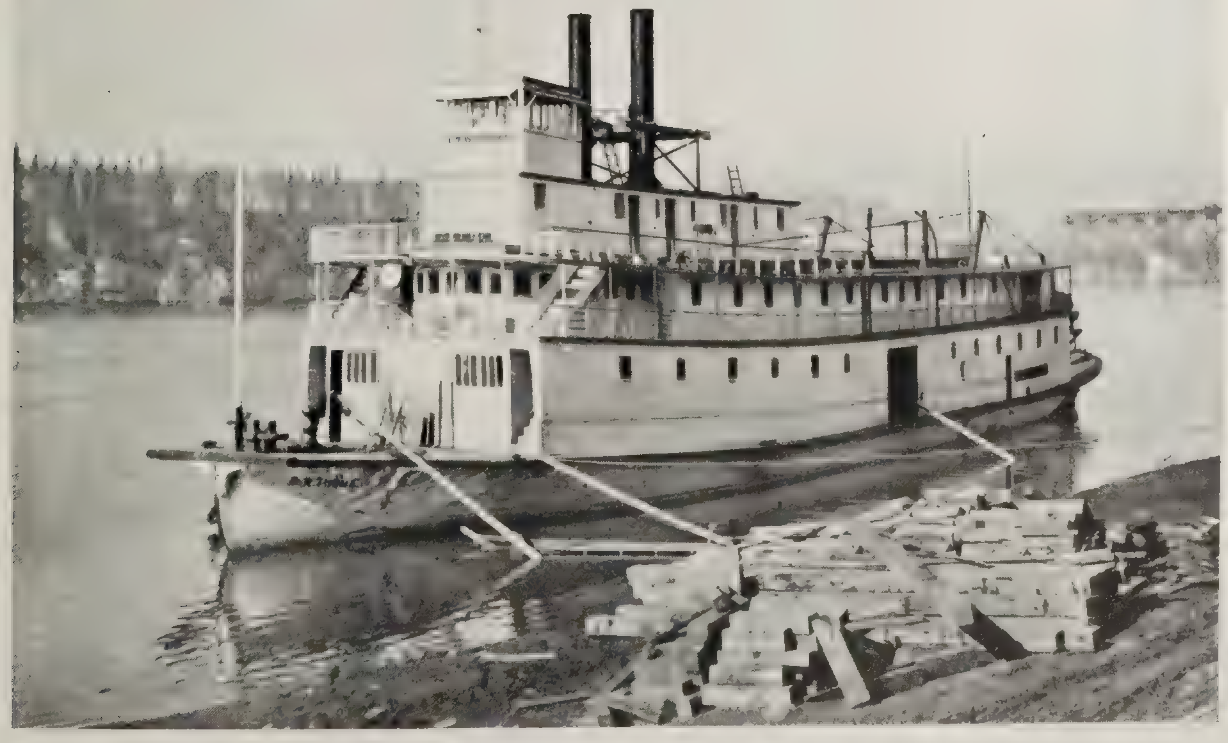

FIG. 15

FIG. 14—The Hudson's Bay Company's steamer *Grahame*, Lake Athabaska, June, 1914. The *Grahame* is a typical stern-wheeler that has seen service since 1882. (Photo by Francis Harper.)

FIG. 15—Modern transportation on the Peace River: the steamer *D. A. Thomas* at Peace River. (Photo by F. H. McLearn.)

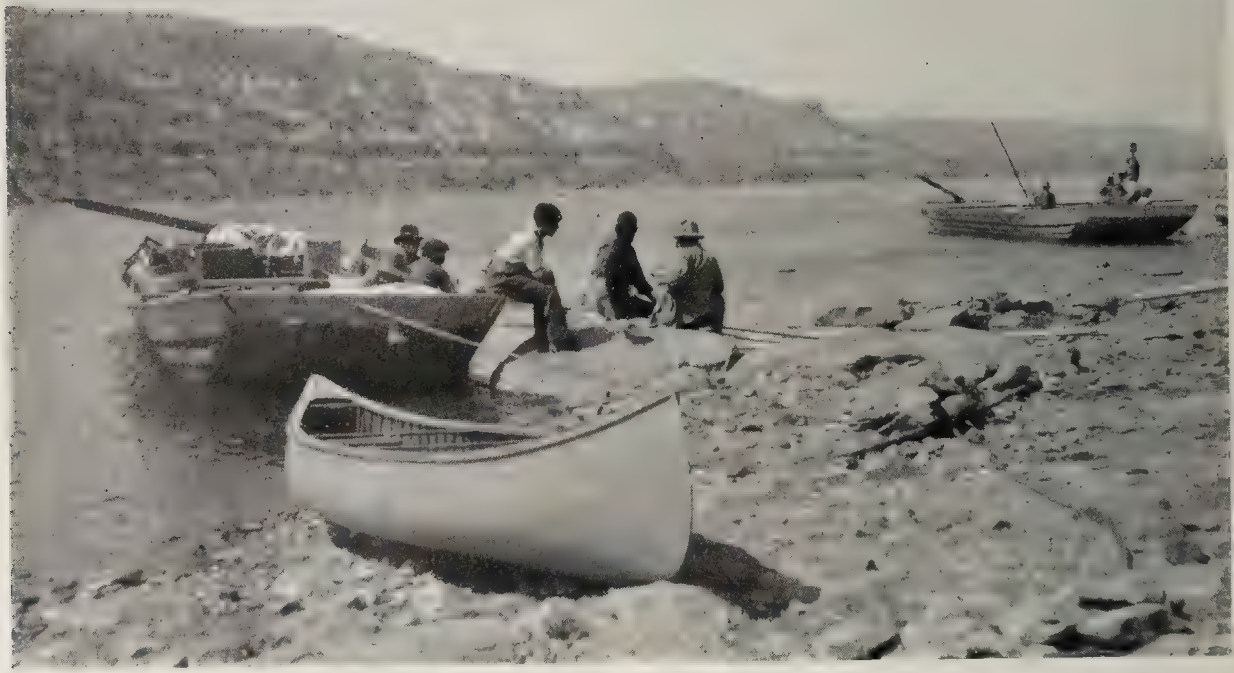

FIG. 16

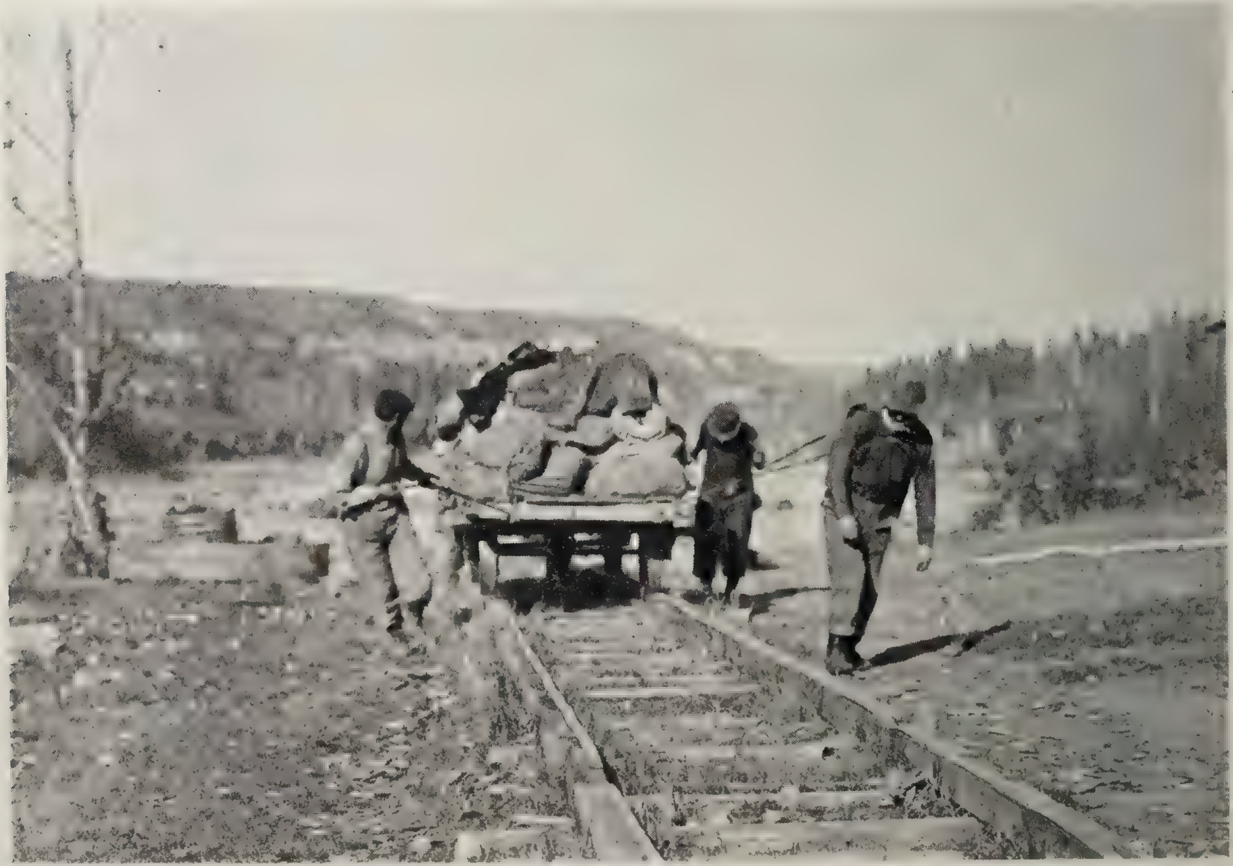

FIG. 17

FIG. 16—At the head of the Grand Rapids of the Athabaska River. (Photo by F. J. Alcock.)

FIG. 17—The tramway across Grand Rapids Island, connecting the interrupted reaches of the Athabaska River. (Photo by Francis Harper.)

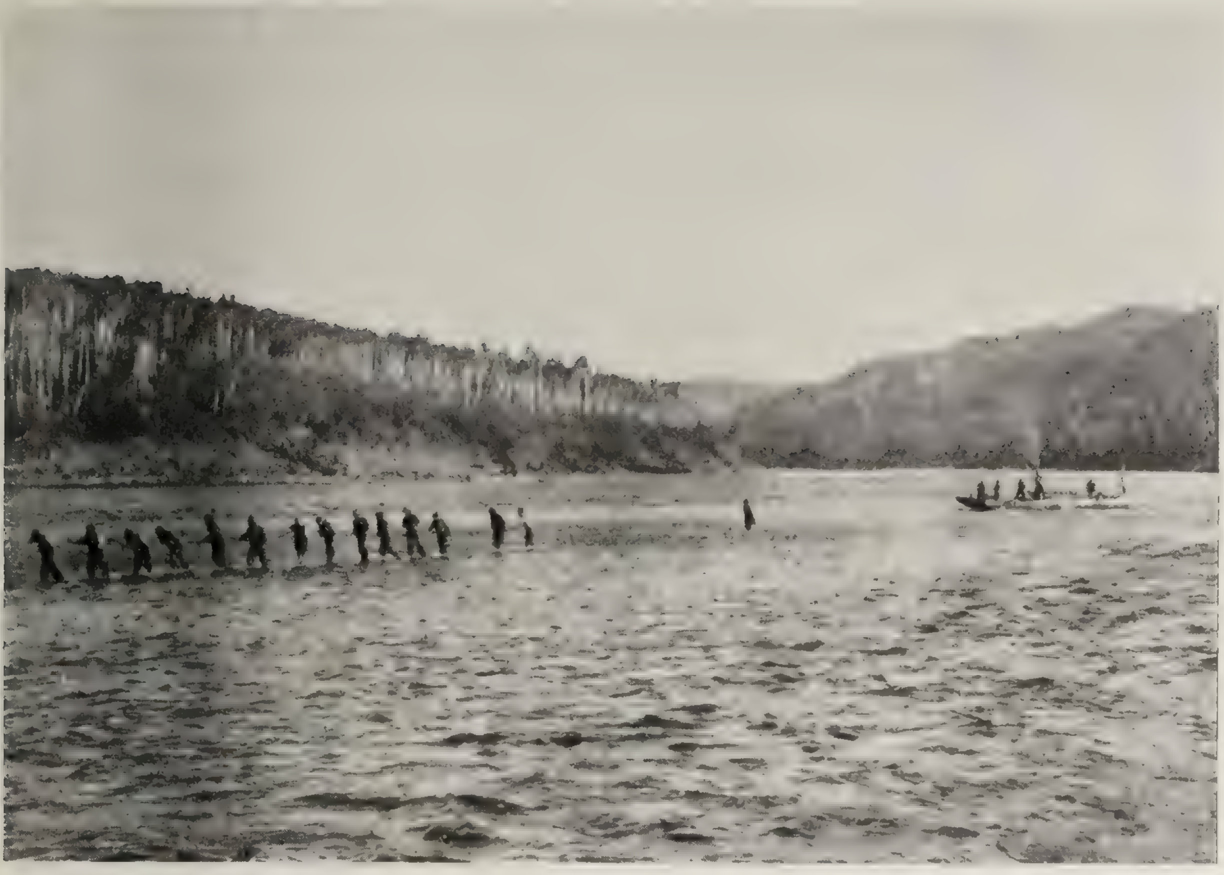

Fig. 18

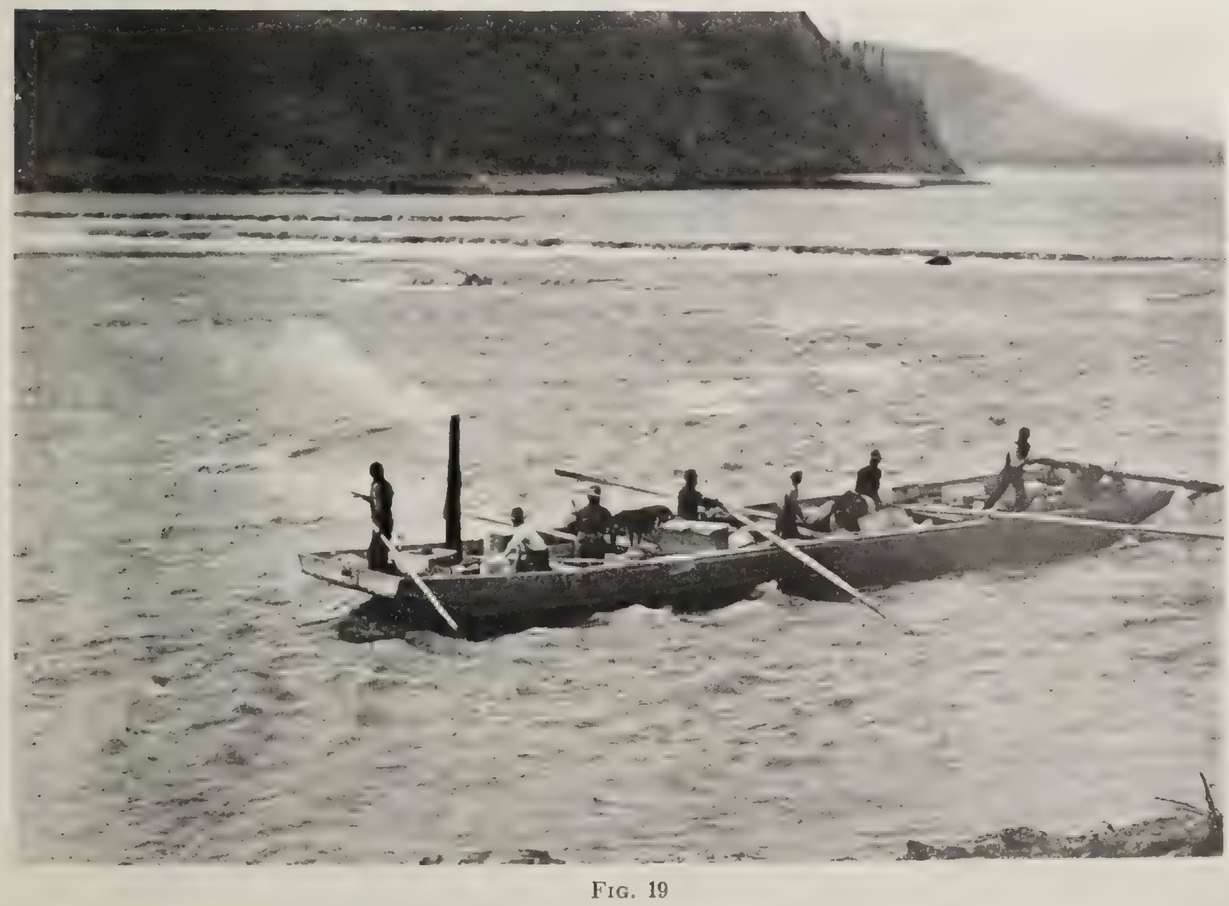

Fig. 19

Fig. 18—Tracking a scow up the Athabaska River. (Photo by Charles Camsell.)

Fig. 19—An Athabaska River scow below the Big Cascade. The Athabaska River scow is the type of boat commonly used on the Athabaska, Slave, and Mackenzie Rivers. (Photo by Francis Harper.)

The Plains Routes

For twenty years after the arrival of the first contingent of Lord Selkirk's settlers at the Red River, all the supplies for the colony came in from York Factory. In 1832, however, a considerable trade between St. Paul and the Red River settlements began to be conducted by private merchants who carted their goods overland. Finally in 1860 the Hudson's Bay Company also began to make use of the American railroads. A stage line was established between the town of St. Cloud on the Mississippi River and Georgetown on the Red River, and from Georgetown communication with Fort Garry at the junction of the Red and Assiniboine Rivers was effected by river steamer. Private traders were compelled to freight their goods overland from St. Cloud until 1871, when an opposition steamer began to make trips between Moorhead and Fort Garry. With the arrival of the Northern Pacific Railway at Moorhead in 1872 the new route to the Red River district became the important one, and a fleet of steamers and barges were soon engaged in the trade.

The new route resulted in making Fort Garry, or Winnipeg, the point of entrance to the Canadian West, and, as it increased in importance, York Factory proportionately declined. One by one the trading districts of the interior ceased sending their boat brigades to York and began to get their supplies through Fort Garry, until York became, what it remains today, merely the head post for the Hudson Bay district.

RED RIVER CARTS

With Fort Garry as the new headquarters, supplies were carried to the Western posts by cart brigades. In the year 1876 between four and five thousand carts were loaded at Winnipeg to cross the plains. The cart employed was a unique two-wheeled affair made entirely of wood and had the reputation of being able to go anywhere, no matter how rough the country. It was drawn by a single animal, either ox or horse, and carried on an average from eight hundred to one thousand pounds. One of its most characteristic features was its melancholy squeaking. The carts, often one hundred to a brigade, usually traveled in single file along trails that were followed year after year. In places along the more commonly used routes, such as the trails to Edmonton and Battleford, as many as twenty deep parallel ruts marked the course. From Winnipeg to Edmonton the distance by cart trail was 890 miles.

The Saskatchewan Steamboats

In addition to the Red River cart, another method of transportation came into prominence which further took the place of the York boat in freighting on the Saskatchewan. This was the river steamer. Between the years 1870 and 1886 seven large stern-wheel boats were built and operated on the Saskatchewan River carrying supplies from Grand Rapids as far as Medicine

Hat on the South Branch and Edmonton on the North Branch. These boats varied in length from 100 to 210 feet, and one of them was built of steel. Navigation was often difficult, owing to shallow water, shifting bars, strong currents, and stretches of swift water, up which the vessels had to be winched.

In the early years of the Saskatchewan steamers the cargoes were brought partly from York Factory and partly from Fort Garry by steamer up Lake Winnipeg to Grand Rapids, where they were portaged across on the tramway. At first the river steamers ran only as far as Fort Carlton or Prince Albert. From here the freight for the North country was carted overland to Green Lake, a distance of approximately one hundred miles, and then taken down the Beaver River to Lake Isle à la Crosse on the Churchill River and from there along the old York boat route to Methye Portage. Beginning in 1877, however, the steamer service was extended on up the Saskatchewan as far as Edmonton. In 1886 the long trips from Grand Rapids to Edmonton were abandoned owing to the shallowness of the river and the approach

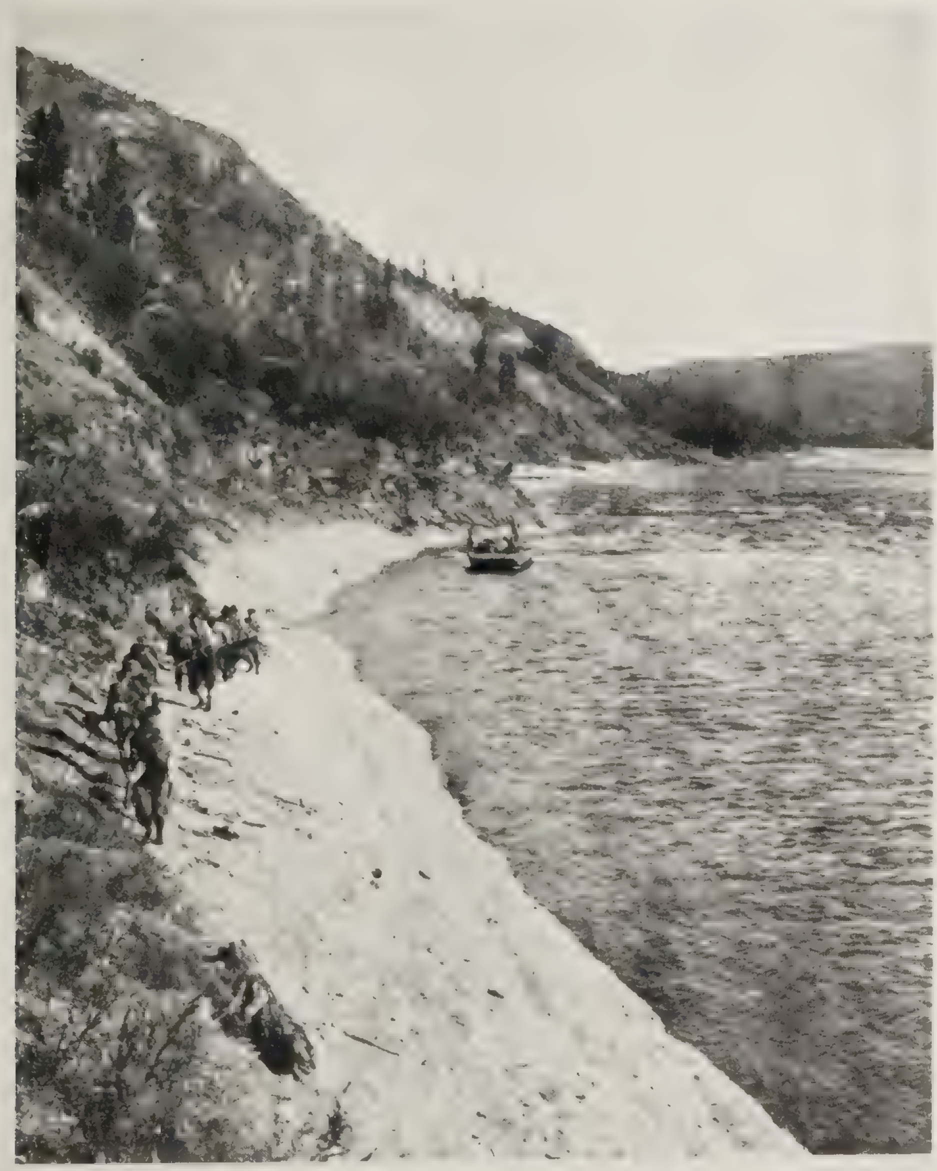

FIG. 20—Tracking a scow up the Athabaska River. (Photo by Charles Camsell.)

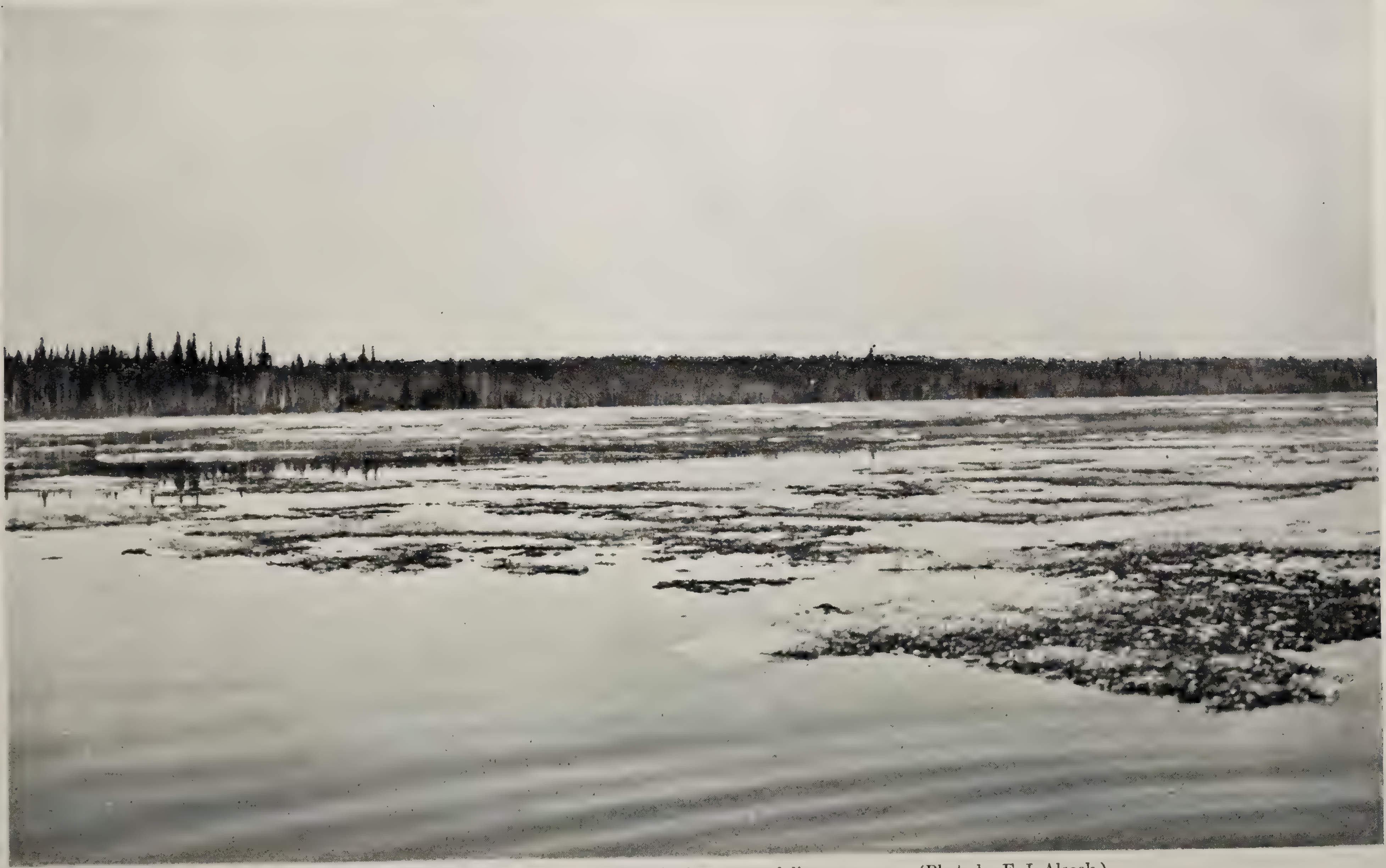

Fig. 21—A Northern lake in June. Note the ice in process of disappearance. (Photo by F. J. Alcock.)

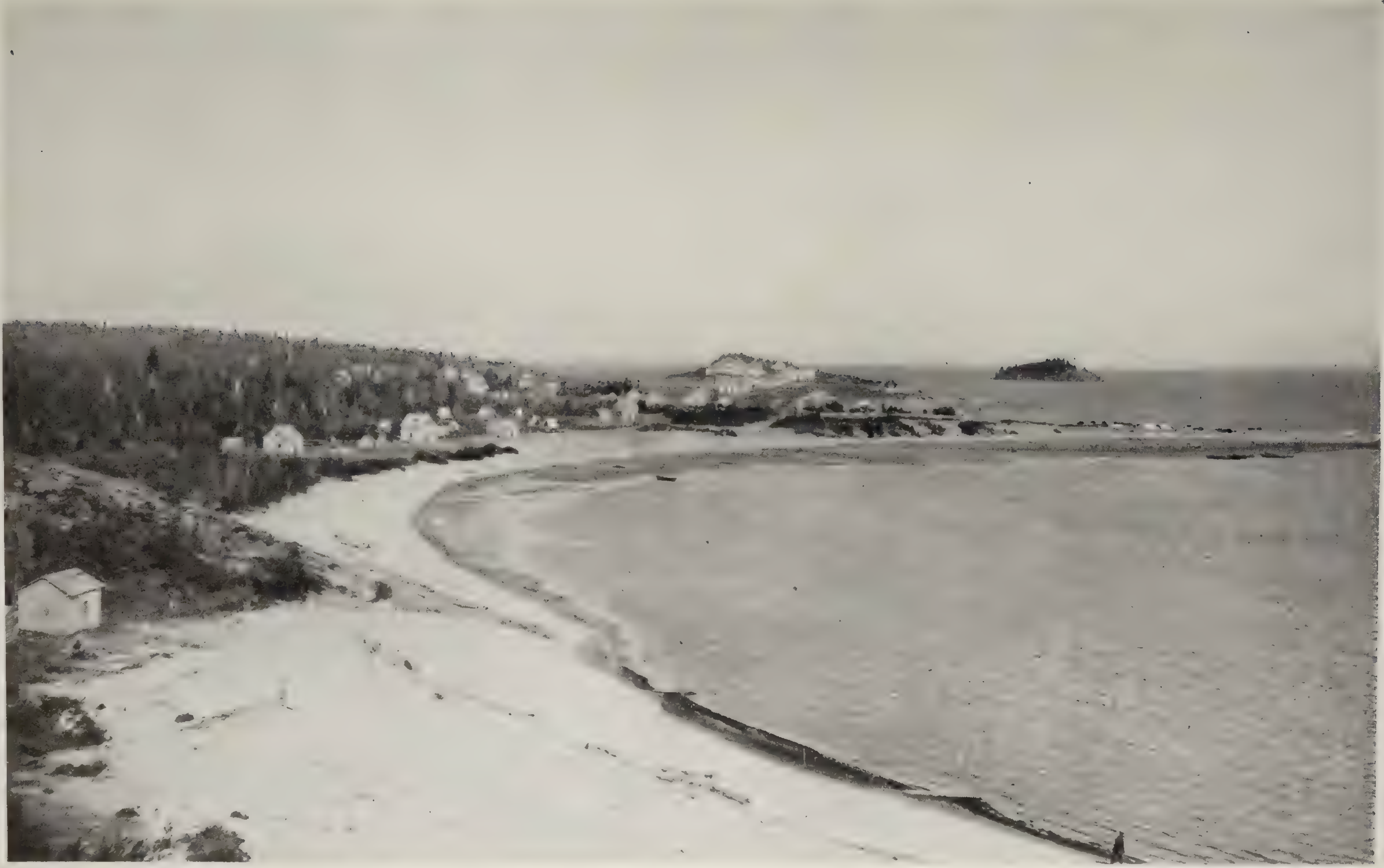

Fig. 22—Fort Chipewyan, an important distributing post of the Hudson's Bay Company at the western end of Lake Athabaska (Photo by F. J. Alcock)

of the railway to Prince Albert and Edmonton, from which places supplies were transported across the plains by carts. Though a few trips as far as Edmonton were made as late as 1891, very little navigation was carried on along the Saskatchewan from 1886 until 1904, owing to the advance of the railway and to the fact that settlement was taking place along it rather than along the river.

The Athabaska Routes

Mention has been already made of the different modes of transportation to Methye Portage and of the route from there down the Clearwater and Athabaska Rivers to Fort Chipewyan, the important distributing post of the North situated at the western end of Lake Athabaska. From it supplies were sent up the Peace River, down the Slave and Mackenzie Rivers, and east along Lake Athabaska to Fond du Lac.

An alternative route to Fort Chipewyan led from Edmonton on the Saskatchewan to the Athabaska River, a trail approximately 100 miles in length connecting Edmonton and Athabaska Landing. This would early have led to the abandonment of the Methye Portage route had it not been for the character of the Athabaska River between Athabaska Landing and Fort McMurray, situated at the junction of the Clearwater with the Athabaska. Immediately above Fort McMurray the Athabaska for a distance of about 90 miles is broken up into a series of rapids connected by stretches of smooth water. One of these, the Grand Rapids of the Athabaska, long presented greater difficulties than the Methye Portage, and it was not until an Athabaska boatman, Louis Faissonneuve, known on the river as "Captain Shott," demonstrated that a scow could safely be run down the Grand Rapids that the old route by the long portage became entirely abandoned. Henceforth all the supplies for the Northland came by way of Edmonton and Athabaska Landing. In 1891 the railway reached Edmonton, but it was not until 1912 that the freight train superseded the wagon on the trail from Edmonton to Athabaska Landing.

METHOD OF TRANSPORTATION

Transportation down the Athabaska was by river scows, boats built for drifting downstream. The Athabaska River scow is a flat-bottomed boat, having a length of 50 feet and a width of 12 feet at the top and 8 feet at the bottom. It is planked with inch lumber and calked with tar. A sweep 35 feet in length, balanced at the stern, is used for steering, and by it a single steersman can guide the drifting craft. Four oars, each 22 feet in length, are used for rowing when it is necessary to aid the steersman. While the Athabaska remained the important route to the north, as many as one hundred scows were run down annually from Athabaska Landing to Fort Chipewyan. As a rule the scows made but one trip, being broken up for lumber when they reached Lake Athabaska.

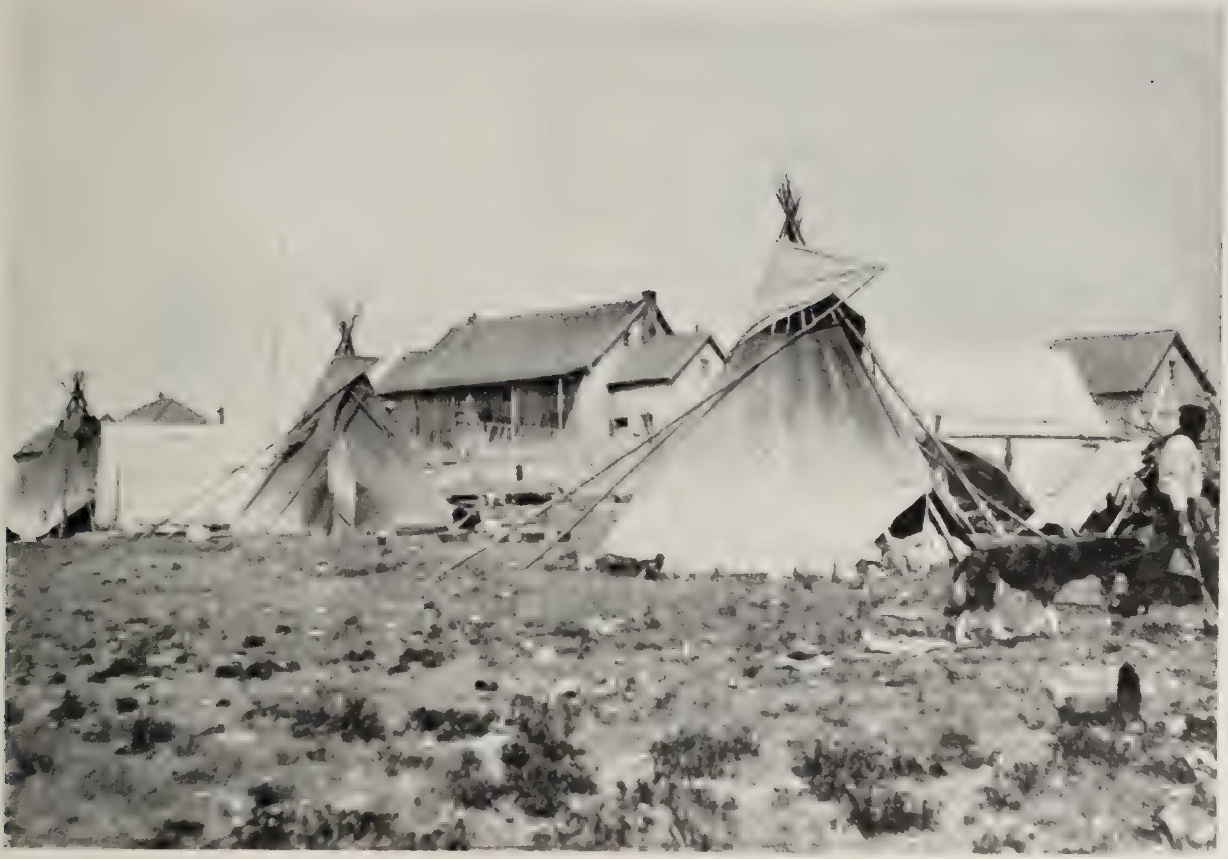

Fig. 23

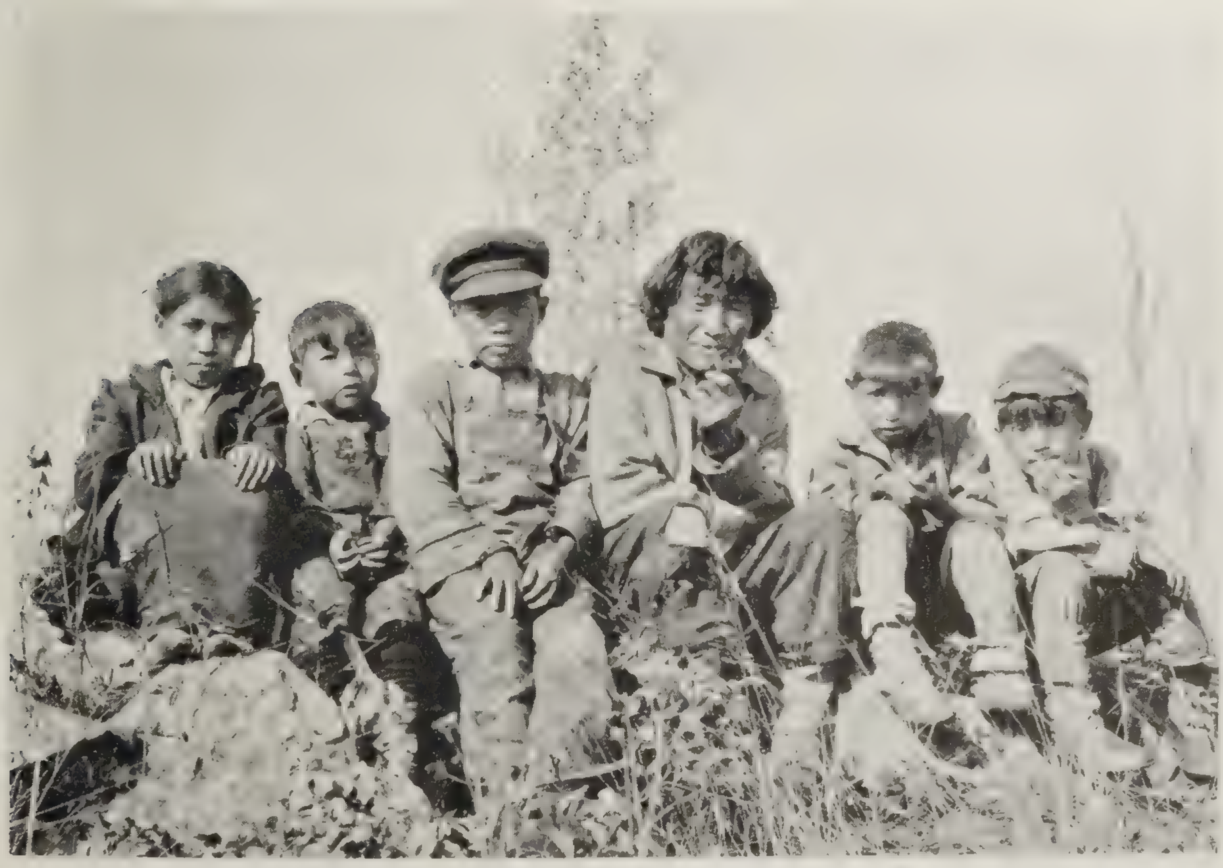

Fig. 24

Fig. 23—Some tepees of Chipewyan Indians and the Roman Catholic Mission of Fond du Lac at the eastern end of Lake Athabaska. (Photo by F. J. Alcock.)

Fig. 24—A Cree Indian and his grandchildren, Cranberry Portage, Manitoba. The Crees, to the south of a rough boundary marked by Lake Athabaska and the Churchill River, and the Chipewyans to the north of it, constitute the two main Indian stocks inhabiting the Canadian Northwest beyond the settled belt. (Photo by E. L. Bruce.)

The first one hundred miles below Athabaska Landing the river flows smoothly, and the scow brigades could drift downstream steadily both day and night. A few rapids are then easily run, and another fifty miles brings one to the Grand Rapids of the Athabaska, where in a distance of less than one mile the river falls sixty feet. An island in the middle of the rapid divides the stream into a right and a left channel. The left has the greater volume of water but is so rough that canoes and scows never attempt it. Scows were run to the head of the island in the middle of the stream and unloaded. An experienced steersman with a picked crew at the oars and men at the bow with poles would then run the scow down the right-hand channel. A rope fastened to a log run out from the lower end of the island would be picked up by the men on the scow and the scow pulled up to the foot of the island. In the meantime the cargo could be portaged over the island by means of several small flat cars on a rough tramway. This miniature railway, which was maintained by the Hudson's Bay Company until 1915, not only transported all their own supplies over Grand Rapids Island, but turned in an annual profit to the company from the freight charges collected from other users.

Below the Grand Rapids, other rapids follow in swift succession; two of these, known as the Little and the Big Cascades, where the river drops over low limestone ledges, sometimes gave trouble to the scows in periods of low water. Arrived at Fort McMurray at the mouth of the Clearwater River, there were no more rapids to be encountered for the remainder of the journey to Fort Chipewyan. In fact, from Fort McMurray to the Arctic Ocean the only break that river steamers cannot pass is the rapids on the Slave River between Lake Athabaska and Great Slave Lake; a wagon road sixteen miles in length connects Fitzgerald and Fort Smith at the two ends of this rapid. As early as 1882 the Hudson's Bay Company had a steamer, the *Grahame*, on the lower Athabaska and since that time has maintained steamers on the Peace, Athabaska, and Mackenzie Rivers.

Recent Railroad Development

Just as the advance of the railroad on the plains in 1886 was largely responsible for the decline of steamer freighting on the Saskatchewan, so more recent advances have effected similar changes in connection with the Athabaska routes. In 1915 a line of railway from Edmonton reached the town of Peace River, and trade for the North began to go by way of the Peace instead of down the Athabaska. The Peace is the slightly larger river and, for a distance of 770 miles from Fitzgerald on the Slave River to Hudson's Hope above the town of Peace River, the only break to steamer navigation along its course is at Vermilion Chutes, about 300 miles below Peace River. Stern-wheeled steamers ply both above and below the Chutes, and a wagon road 4½ miles in length is used for teaming the cargoes from one steamer to another. It is interesting to note that the year 1914, which was the last year for the Athabaska scow brigades to take the northern freight to Fort

Chipewyan, was the year of the death of "Captain Shott" at Athabaska Landing.

A new line of railroad is once again to change the route to the Mackenzie River region. A railroad from Edmonton to Fort McMurray on the Athabaska River below all the Athabaska rapids is nearing completion. Communication will then readily be made by rail to Fort McMurray and from there by steamer to Fort Chipewyan and Fitzgerald. Fort McMurray will accordingly supersede Peace River as the rendezvous for the Northern trade just as the latter superseded Athabaska Landing in 1915, and once again the Athabaska River will become the route to Lake Athabaska and the Mackenzie River country.

The railway has also recently advanced into the North country in a different direction. In 1908 location work was begun by the government of Canada on a railroad to the shores of Hudson Bay. Since 1917 work on the road has been suspended, but at the present time the steel is laid to within 92 miles of the bay, and considerable progress has been made in establishing a terminal at Port Nelson at the mouth of the Nelson River near York Factory. A fortnightly train service is maintained at present from the town of The Pas over the line as far as Mile 214. It is hoped that the new Hudson Bay route will some day become one of the main trade routes of the Canadian West, giving an outlet to Europe for the grain fields of Western Canada.

In the regions where the railroad has not as yet penetrated, relics of the old methods of transportation are still encountered. The canoe as used by the North-Westers is still the common method of summer transportation as soon as one departs from the railroad or steamer routes. Though Norway House is now supplied by the Lake Winnipeg steamers, York boat brigades still ply on the Nelson and the Echimamish between Norway House and Oxford House. The Red River cart, on the other hand, has entirely disappeared. In 1912, when the Lord Selkirk Association celebrated the one hundredth anniversary of the arrival of the first contingent of Lord Selkirk's settlers into the Red River district, an effort was made to collect specimens of all the utensils and implements used by them. Among other things a Red River cart was desired, but search for one was made in vain from Winnipeg to Edmonton, and one had to be manufactured. Within the last few years, the Athabaska River scow has likewise become relatively a thing of the past, its place having been taken by the river steamer. The importance of the latter is increasing. On the Saskatchewan River since 1904 about twenty steam vessels of various sizes and types have been operated from local points, and at the present time about ten of these still operate, with the town of The Pas as their home port, being largely engaged in the traffic with the new mining region north of Cumberland House.

GERMANY'S LOST PACIFIC EMPIRE

By the late WILLIAM CHURCHILL

Chronology

1883 Annexation by Queensland of New Guinea east of the Dutch boundary at 141° E.

1883 Annexation annulled by Great Britain.

1884 October to December. Germany annexes Kaiser-Wilhelmsland (the northern shore of New Guinea east of 141° and inland to the central ranges) for the Deutsche Neuguinea-Gesellschaft, the New Britannia Archipelago (changing its name to the Bismarck Archipelago), and the Solomon Islands as far south as the strait between Ysabel and Malaita.

1884 November. Great Britain proclaims protectorate over British New Guinea (the southern shore east of 141° and inland to the central ranges), turning over administration to Australia, and over the southern Solomon Islands and the Santa Cruz group.

1885 August 25. German flag hoisted over Yap in the Caroline Islands. Spain protests the annexation, the matter being referred to the Holy See for arbitration.

1885 October 15. German flag hoisted at Jaluit in annexation of the Marshall Islands in the name of the Jaluit-Gesellschaft.

1885 Queensland re-annexes southeastern New Guinea.

1899 Germany buys from Spain the Carolines, Pelews, and Marianas.

1899 November 14. Germany completes the partition of Samoa on the dissolution of the Berlin General Act of 1889.

1914 September to December. Capture of Samoa by New Zealand, of New Guinea by Australia, of the equatorial islands by Japan.

Creation of a German Colonial Empire the Outgrowth of West German Industrialism in Opposition to Prussian Agrarianism

It is eminently characteristic of German administration that the very last item of acquisition of Pacific territory was really the first object of Germany's plans for her place in the sun. It was even more. The project for the annexation really underlies the whole German plan of creating a German empire. In the new government proclaimed at Versailles at the end of the Franco-Prussian War, the use of the term "empire" was in part braggadocio and in other part an attempt to establish a continuity of system with the Holy Roman Empire of the Middle Ages. That government was at the beginning, as at the end, a government of the more civilized Germanic states by Prussia. It was Bismarck and Prussia, the agrarian interest which could find its only active outlet in war, as opposed to the industrial and literary culture of the Rhine valley.

The point is one of extreme importance. The attitude of the German Empire toward colonies is not merely a matter of inference to be drawn from Bismarck's administration but is based upon the direct and positive statements of the Iron Chancellor himself. In the settlement of the terms of the peace with France, it was proposed that Germany take over Pondicherry and the other French holdings in India and the Far East. Bismarck roundly denounced the project and swore that Germany not only needed no colonies but could not tolerate them.

Yet, there was another Germany which not even Bismarck could grind down. Even in the era of the Hohenstaufen emperors and popes there existed communities, city states, with full control over their own affairs and entirely free of the domination of clerical and feudal lords. These were the Hanseatic republics—Hamburg, Lübeck, Bremen, Riga, and the rest. They had established complete control over the trade of the North Sea and the Baltic. They had settled themselves in London itself at the Steelyard and had so throttled England's commerce at its beginning that from their popular designation of "Easterlings" to this day the soundness of British finance must be stated in terms of the pound sterling. In the ordinary course of political events they found it necessary to associate themselves with their great and rude neighbor of Prussia on the east, for mutual protection. With Prussia they entered into the North German Confederation and joined with Prussia in the conquest of Schleswig-Holstein, of Bavaria, of Württemberg, and Austria, and eventually in the victory over France. The interests of the states of the Hanseatic League were overseas; their profit lay in procuring

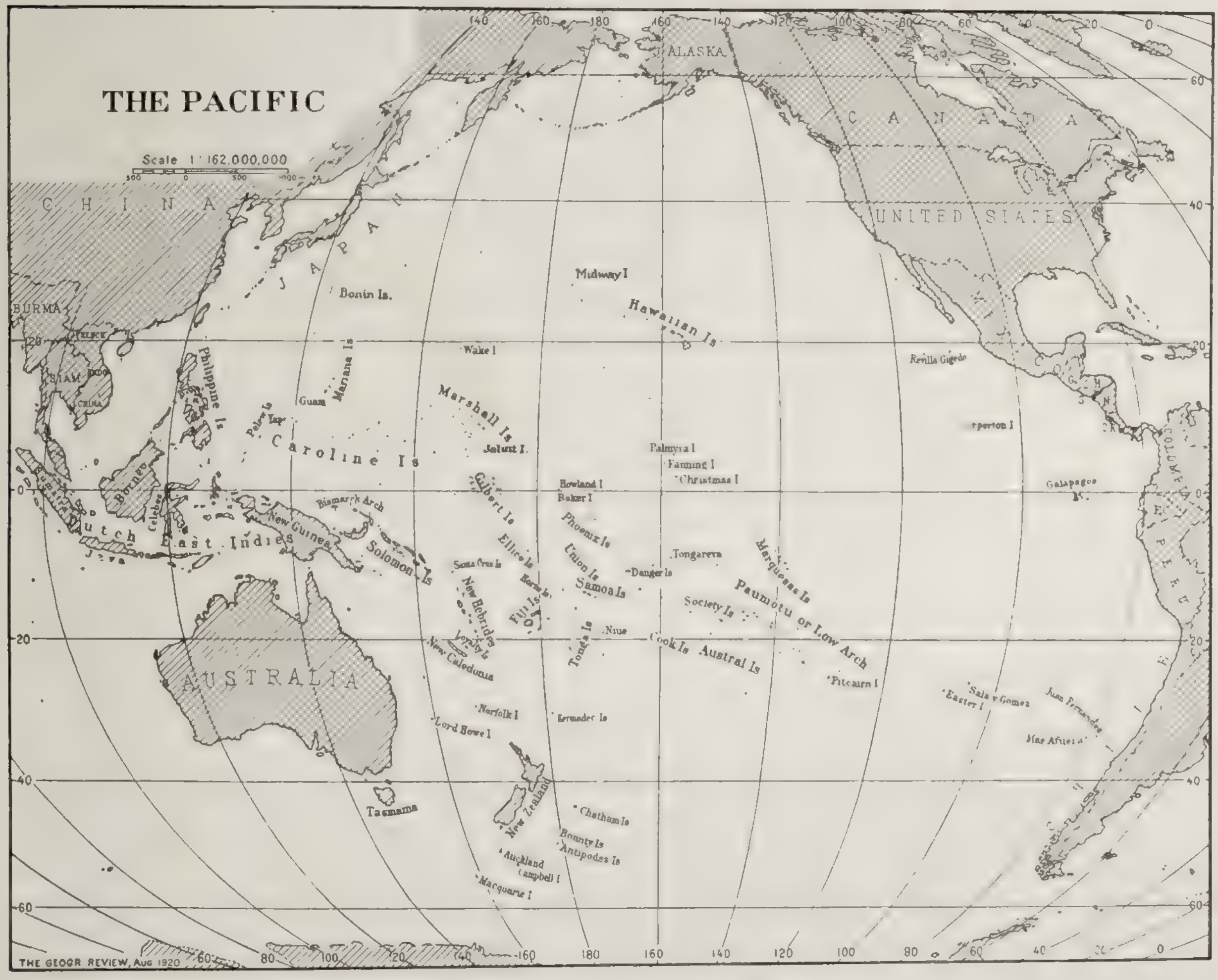

FIG. 1—Locational map of the Pacific islands. Scale, 1:162,000,000.

the raw material upon which German craft and industry might exercise its constructive skill; their interest was none the less in finding a market for the product of German industry. Their capital must be fluid; their profit lay in the extent and frequency of the turn-over. Prussia, on the other hand, had no industry save that of farming—agriculture upon a great and feudal scale. Intimately as the Hanseatic League and Prussia found it necessary to associate themselves for purposes of government, their interests and objects were irreconcilable. Prussia was stagnant; Hamburg, type of its sister communities, had to exercise to live. It had to foster the development of the great industrial centers of the Rhine valley and the Palatinate, and that called for capital and yet more capital. It was inevitable that Hamburg should associate itself with the great banking interests which established themselves in Berlin after Frankfort had ceased to be the money center of northern Europe. Commerce and finance combined for the overthrow of Bismarck first, and eventually for the destruction of the empire of force which he had created.

The House of Godeffroy and the Acquisition of Germany's Pacific Colonies

One result of the effective blockade of the Southern seaports in our Civil War was to produce the cotton famine which, while advantageous to the valley of the Merrimac and southeastern New England, was ruinous to the English Midlands, the valley of the Rhine, and to the world at large. In all the warmer regions of the world every district in which cotton might be made to grow was exploited for the production of the great staple. The very life of Hamburg and Bremen and Lübeck depended upon the supply of cotton.

In Hamburg there was a merchant prince, Johann Cesar Godeffroy, merchant in the richest sense of the word, senator of the Golden Senate of his state. In search of cotton he sent out to the heart of the Pacific, to Fiji and Samoa, agents whose sole purpose was to establish plantations to relieve the dearth of Germany. The principal agent of the house of Godeffroy in the Pacific was Theodor Weber. Weber was a fit assistant to carry out the broad plans of his chief. His ability was recognized, first by his state, which created him Commercial Agent of Hamburg for the South Seas, and next by the North German Confederation, which appointed him its Consul, an honor which was carried over by the German Empire. Weber among savages beneath the palm trees, Godeffroy in Hamburg, manipulating a dream of world commerce, shared a vision—the vision of a German Empire which should establish itself in occupation of the Pacific Ocean. By reason of his daring extension of business Godeffroy brought his house into bankruptcy after a century and a half of great success; his mistake was in the exploitation of the Westphalian coal measures before German industry was ready to swallow the project. In the bankruptcy it was found that his South Sea operations were sound and paying, and these interests were assumed by a joint stock corporation, Die Deutsche Handels- und Plantagen-Gesellschaft der Südsee-Inseln zu Hamburg. It is a matter of common note that a block of shares of this new company was allotted to members of the ruling family. The shareholders, under the leadership of the great Berlin banker Bleichröder, despite the opposition of Bismarck, forced through the Reichstag a subvention in aid of the new establishment. This was the beginning of the end of Bismarck, and in a few months the pilot was dropped; German business had won its first victory over Prussian militancy.

The Case of Samoa

It was not going to be easy for Germany to take over Samoa. Other interests were involved. The British colonies of Australia and New Zealand had established a lucrative trade. The United States since 1839 had the exclusive right to the establishment of a naval base in the harbor of Pagopago. The clumsiness of the execution of adroitly planned German machination in stirring up disorder among the Samoans actually brought the United States in 1889 to the point of the immediacy of war, a horror prevented only by the intervention of the gale which destroyed every ship in Apia harbor, except the British *Calliope*, which escaped by the merest thread. This led to a conference of Great Britain, the United States, and Germany in Berlin, resulting in the Berlin General Act, which undertook to provide a government for the Kingdom of Samoa and to protect it against the schemes of greedy nations.

It is for that reason that Samoa, the very best of Germany's colonial empire, remained the last territory to be annexed.

British and German Acquisitions in New Guinea

The colonies of Australia, now unified in the Commonwealth, felt pride in being outlying members of the British Empire, but for all practical purposes they regarded themselves as independent constitutional communities. In connection with the slave trade necessary for the working of the sugar plantations in tropical Australia, a trade which was allowed to exist under the more seemly designation of the labor trade, the colony of Queensland in 1883 annexed the eastern half of the continental island of New Guinea, whose mountain summits lay on the other side of the narrow Torres Straits. When this independent act of the colony was reported in London Lord Derby at once disavowed the act of sovereignty on the ground that a colony had no right to annex territory to itself. This created a storm, not only in Queensland, but in the other colonies of Australia, and public meetings of protest were held in Brisbane, in Sydney, and in Melbourne, and all the colonial parliaments passed various measures complaining of this invasion of their rights. Germany seized the opportunity and, in the last months of 1884, annexed the northern shore of New Guinea from the Dutch boundary eastward to Dampier Strait and the territory back of it theoretically to the crest of the central range of mountains. This was done, not as an imperial act, but as the placing in possession of the land of Die Neuguinea-Gesellschaft, imitative of the British chartered companies in South Africa and in Borneo. Continuing the annexation, but this time as imperial, the expedition assumed the whole of the New Britannia Archipelago and of the northern Solomon Islands as far south as the strait between Ysabel and Malaita. At once Australia was ablaze, and London, yielding at last to the popular sentiment of its great southern dependency, annexed the southern shore of New Guinea and turned it over to Australia for administration; and in the islands Great Britain established a protectorate over the southern Solomons and Santa Cruz.

German Acquisition of the Carolines, Marshalls, Marianas, Pelews, and Samoa

In August, 1885, still in extension eastward in the Pacific, Germany performed an act of annexation over the island of Yap in the Carolines. This group was claimed from the earliest discovery period by Spain, which protested the annexation. By agreement, the matter was referred to the Pope for arbitration, who eventually decided that the title lay with Spain. In October of the same year Germany hoisted its flag over the Marshall Islands, not as an imperial act, but in the form of another company, the Jaluit-Gesellschaft. In 1898 the United States had first captured and then bought from Spain the Philippines and the island of Guam in the Marianas. The following year Germany bought from Spain for 24,000,000 pesetas the remainder of its now useless Pacific holdings, the Carolines, the Marianas, and the Pelews (German, Palau). Toward the end of the same year, following the war upon the death of King Malietoa, the Berlin General Act was annulled by consent of the three nations and Samoa was distributed: Tutuila to the United States; Upolu to Germany; Savaii to Great Britain. Immediately Great Britain and Germany adjusted the tangle of other affairs in the Pacific, Germany receiving Savaii and in return making various concessions to Great Britain in the Tonga and the Solomon Islands.

Status of Colonial Dominion in the Pacific in 1900

Thus, with the end of the century an equilibrium was struck in the tropical Pacific. France was in possession of the Society Islands, the Marquesas, and the Paumotus in the extreme east and of New Caledonia and the Loyalty Islands in the west, together with the insignificant missionary property of Uea and Fotuna in the center between Fiji and Samoa, and a joint administration of the New Hebrides shared with Great Britain. The British Empire held, either as protectorates or by direct annexation, the greater part of the Solomon Islands in the west, Fiji and Tonga in the center, and north of Samoa toward the equator the Tokelau (Union) and Gilbert groups, together with an abundance of scattered and less important islands. Germany held Samoa in the center and along the equator extensive possessions in New Guinea, the Bismarck Archipelago, the Pelews, the Marianas, the Carolines, and the Marshalls. The United States had Tutuila in Samoa to the south, Hawaii to the north, Midway and Wake Islands in the open sea, Guam in the Marianas, and the Philippines. The interests of these great powers fall into two distinct groups. Great Britain, France, and Germany exploited their possessions in the Pacific in the interest of commerce and productive agriculture; the United States was and is interested solely in the maintenance of unimpeded communication between its great outpost of Hawaii and the Philippines. These great powers differ in their holdings in another and most important regard. Great Britain, France, and the United States are in a position to control the passage through the East Indian archipelago. Germany has been unable to obtain a foothold in the Malay East.

Changes of Ownership in 1914 Owing to the War and Their Strategical Significance

This condition of equilibrium existed for thirteen and one-half years. Then came the war. New Zealand on its way to the Mediterranean took German Samoa without resistance. The forces of the Commonwealth of Australia gathered the German Solomons and the Bismarck Archipelago and were occupied for several months in quelling German opposition in New Guinea. Neglecting for the time the strong fortification Kiaochow, the Japanese picked up the equatorial possessions of Germany from the Pelews to the Marshalls. Under the unusual designation of mandataries, the possession of these several members of the former German empire of the Pacific remits to New Zealand, to Australia, and to Japan.

It stands clear among the problems of the greater strategies that no Atlantic power can afford to fight for the possession of any Pacific holdings; that no Pacific power can afford to let them go. Thus, there was no attempt on the part of Germany to make any determined effort to hold its Pacific empire; it was content to let it pass to enemy hands at the beginning of the war, knowing that the eventual fate must rest in the outcome of the war as fought in Europe. The British Empire in assuming its share of the former German possessions is in a dual position. As Great Britain, an Atlantic power, it can have no need of these islands; but constituent members of the empire, the Commonwealth of Australia and the Dominion of New Zealand, are essentially Pacific lands at the present and inevitably will develop to a position of greater importance in that regard. It is, therefore, eminently fitting that these two constitutional states should assume the control of the contiguous Pacific area.

The Present Position of the United States in the Pacific

The position of the United States in the Pacific was in no sense threatened by Germany in the war; Hawaii and Samoa at the east and Guam and the Philippines at the west were not the object of German attack, and, superficially, it may seem that they are not affected by the distribution of the German islands in the Pacific. It is to be noted, however, that the equatorial islands from the Marshalls to the Pelews are parallel to an important American line of communication, namely that from Hawaii to the Philippines. The lines are not exactly parallel, but sufficiently so for practical purposes. At the east Jaluit lies about 500 miles to the south of the American line of communication, a distance which in modern warfare we have learned is to be covered in a very scanty tale of hours; toward the west the distance is reduced to 47 miles, that being the interval between American Guam and Rota, the next island in the Marianas, a distance now within the easy scope of modern artillery. Fortunately for the security of our line of communication, these islands have no harbors of a character to serve as bases for capital ships. They do abound, however, in smaller bays and roadsteads, each of which might serve as a store base to be used only once, or to be sacrificed without great loss, by an enemy at the beginning of any war which shall engage in any activity in the Pacific. They would serve equally as ambush for destroyer units prepared to harass our fleets advancing along the great circle to the westward. A particular element is introduced in these equatorial islands by the frequency with which the atoll type recurs. There are hundreds of these islands in which a narrow wall of sand surrounds some considerable areas of water in an inner lagoon and protects it from the oceanic wave movement. There are thus many excellent possible bases for hydro-airplanes with abundant surfaces of smooth water giving an ideal take-off. The late war has shown the great prospect of value in offence which may be expected from airships of this type. The number of these bases is such as to entail a most considerable difficulty upon the commanders of any fleet which attempts to search them out and to clean them up, for the assault upon a vessel having the freedom of the skies presents a task of conspicuous difficulty to a vessel confined to the water.

Along the same track lies another American line of communication and a fixed one. The Pacific cable of the Commercial Cable Company is carried along the bottom of the sea from Hawaii to a relay station at Midway and a point of general distribution at Yap in the Carolines. From Yap an American branch line extends northward to the Bonin Islands, where it connects with the Japanese line with Tokyo. At Yap another connection is made with British lines to the China coast; the American cable extends to Manila, and other connections are made with New Guinea and with Menado on the Gorontalo Peninsula of northern Celebes. These points, which mark out the course of cable distribution, are equally central points in the network of radio communication across the Pacific.

Conclusion

Such is the situation in the South Seas at the end of the war. The period of annexation of these several empires in the Pacific passed over without violence other than intemperate speech. This was followed by a period of equilibrium which was not disturbed by any set of circumstances existing in the Pacific but entirely by conditions whose cause and origin was in Central Europe. The German empire of the Pacific has been wiped out, and new states of control have been established. A new balance has been struck. The future alone can disclose whether a state of stable equilibrium has been reached.

GEOGRAPHIC INFLUENCES IN THE DEVELOPMENT OF THE MENHADEN FISHERY ON THE EASTERN COAST OF THE UNITED STATES

By RALPH H. GABRIEL

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It is the conflict between the land and the adjacent sea that dominates the development of a coast area. In the coastal zone two forces are always at work, usually in opposite directions. If the ocean is productive, a pull is set up which tends to draw the shore dweller away from land and out to sea. If, on the contrary, the country that stretches back from the beach is rich in agricultural or other resources, a counter pull is developed which tends to keep the shore dweller off the ocean and even to draw him inland. Almost every degree of balance and lack of balance is to be found between these two conflicting influences.

There are many cases, however, where the forces of land and water, instead of working in conflict, are actually in harmony. Many times the coast zone and even the hinterland is so unproductive that the man who lives near the shore finds that the land, instead of drawing him away from the water, is steadily pushing him toward it. In contrast to such areas are those where storms, currents, and a forbidding coast line conspire to drive even the most hardy toward the interior. Midway between these two great forces of land and sea, whether they be in conflict or in harmony, lives the shore dweller, his life, to a large extent, the record of the varying fortunes in the eternal struggle between the two dominant forms of the earth's surface.

Neglect of the Menhaden in the Colonial Period

Many an older Long Island resident still lives along the shore of Peconic Bay or Great South Bay who well remembers the time when the menhaden came so frequently to those waters. He can recall the sudden appearance of vast schools of these fish, sometimes hundreds of thousands of them, rushing into the shallow off-shore waters, pursued, perhaps, by some of their voracious enemies, the sharks or the blue fish. The coming of these menhaden, swimming just under the surface of the agitated water, presented a spectacle indeed. From time immemorial these fish have migrated in the months of summer from their winter haunts in southern waters or in the deep sea to cast their spawn in the sheltered coves and inlets of the northern coast. Booth Bay and Cape Ann, Narragansett Bay and Long Island Sound, the Jersey coast, Chesapeake Bay and even Cape Hatteras are the regions to which they have been wont to come. It was in these bays and estuaries that the menhaden fishery began.[1]

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[1] The standard work on the menhaden fishery for the period it covers is G. Brown Goode: The Natural and Economical History of the American Menhaden, Appendix A (=pp. xii + 1-529, with 31 plates, including map of fishing grounds and oil factories, mean scale 1:13,700,000), *Rept. of the Commissioner of Fish and Fisheries for 1877*, Washington, D. C., 1879.

There is a saying among some students of society that man adapts himself to his environment, not so much as it is but as he thinks it is. The traveler among the coast people of New England or Long Island at almost any time during the century and a half of the colonial period would have found a striking illustration of this. To the shores on which these people lived came annually vast schools of menhaden which were allowed to go away again with scarcely a net drawn to catch them. The local fishermen used a few for bait, but there was little more than that. The "mossbunker" was not a food fish and, therefore, was considered valueless. The beginning of the fishery must, on this account, await the time when some important need should arise which the menhaden could satisfy.

Discovery of Value as Fertilizer

By the end of the eighteenth century scanty crops and thinning meadows began to tell the story of the exhaustion which had come to the farm lands of New England and the isolated peninsulas of eastern Long Island. Exploitative and unscientific methods of agriculture had borne their inevitable fruit. For a century and more, the means for replenishing the soil had been at hand, unused and apparently but little thought of. In 1801, however, when the damage had been done and the situation had become serious, Ezra L'Hommedieu, a Long Islander and one of the small group of pioneer leaders in the first American movement for better agriculture, published[2] his conclusions, based on experiments of his own and others, on the possibility of using the menhaden as fertilizer. This was the beginning of new things for Long Island. Three years later President Dwight of Yale College described[3] the change that had come over this region. "Their agriculture has within a few years been greatly improved. . . . The inhabitants have swept the Sound and covered their fields with immense shoals of white-fish, with which, in the beginning of summer, its waters are replenished. No manure is so cheap as this where the fish abound." Eight thousand of these menhaden, worth from $1.00 to $1.50 a thousand, were required to dress an acre of land. As the farmers awakened to the profits to be derived from the new fertilizer, the fishery grew. Scarcely a year passed without making a new record in the number caught. By the middle of the nineteenth century, the business had reached such proportions that "at least one hundred million" fish were "annually taken for this purpose." It was to rejuvenate a worn-out soil, therefore, that the long neglected "mossbunker" became valuable, and, as a consequence, the menhaden fishery, during its first period of development, was dependent upon the requirements of the new agriculture of the early nineteenth century. Better farming and bigger catches went hand in hand.

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[2] *Trans. New York Soc. for the Promotion of Arts, Agric., and Manfrs.*, Vol. 1, 1801, pp. 65–67.

[3] Timothy Dwight: Travels in New-England and New-York, 4 vols., London, 1823; reference in Vol. 3, p. 305

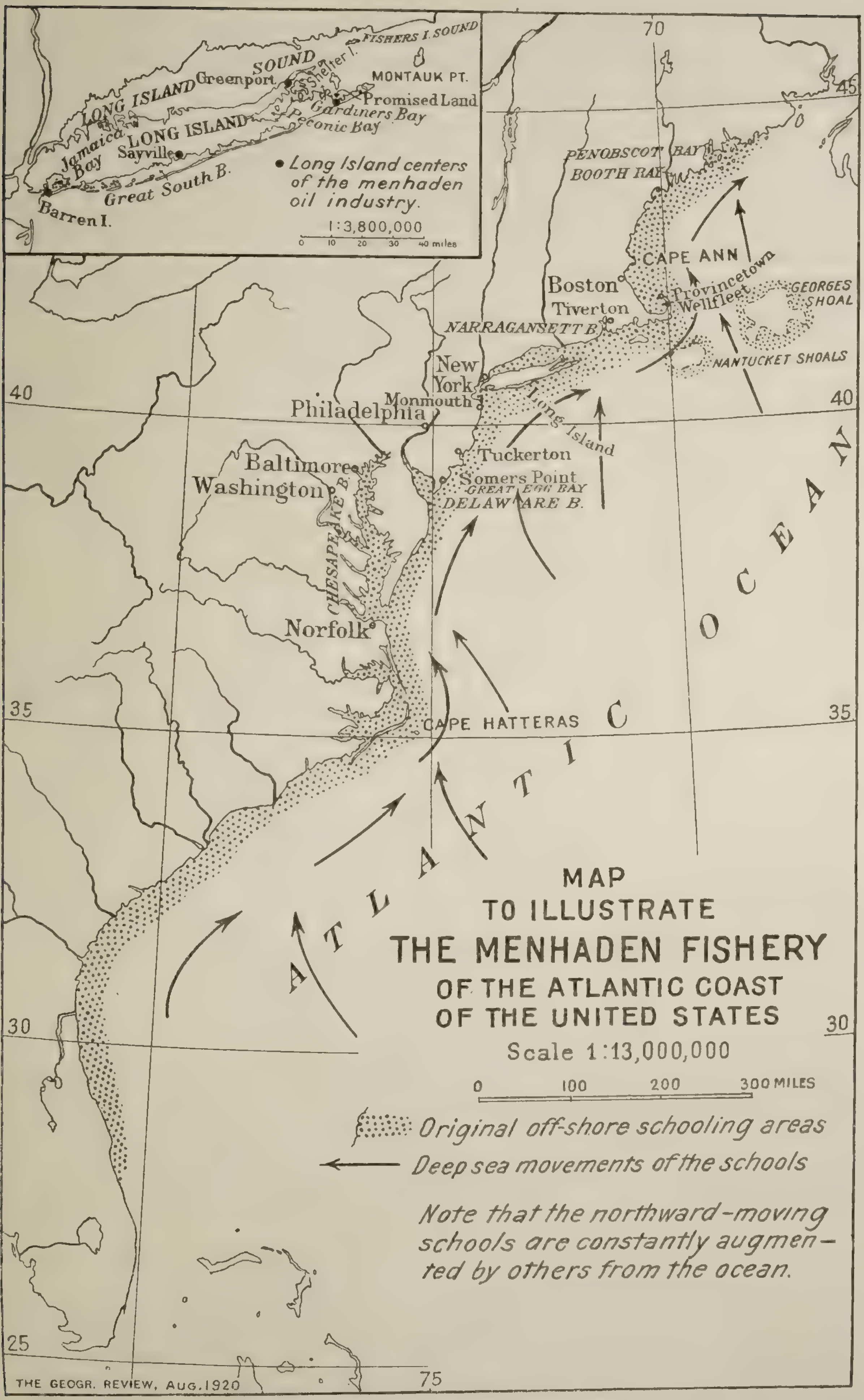

Fig. 1—Map showing the menhaden schooling areas (after G. Brown Goode) and the deep-sea movements of the schools. Scale 1:13,000,000. The inset, 1:3,800,000, shows the centers of the menhaden oil industry on Long Island.

Menhaden Fishery During the "Agricultural" Phase

The organization of the menhaden business during this "agricultural" phase was a simple one. The first fishermen were, mainly, farmers who organized "companies" to go out in boats to capture the schools when they should appear in the neighboring waters. As the demand increased, however, many of these associations began to devote their whole time, during the fishing season, to the taking of "bunkers." Known by such picturesque names as "Coots," "Fish Hawks," "Eagles," "Pedoodles," or "Water Witches," they began to ply a lively business, and, by 1860, a full score of them were to be found scattered along the shores of Peconic Bay alone. Each "company" owned a huge seine, sometimes fully three quarters of a mile in length. A small board shack on the beach was called "headquarters," and in this the equipment was stored. Upon the sighting of a school the "company" would hastily put off in large, sharp-pointed rowboats and bend to the oars to reach the fish ahead of any rival organization. The menhaden would be quickly surrounded, the net put into the water, and the ends of the great seine brought to the shore in the vicinity of the company's house. Horses, harnessed and waiting at the water's edge, would be quickly hitched to the great ropes of the net, and the fish drawn slowly to the beach, a huge pile of glistening "bunkers," sometimes a hundred thousand or more. Catches were usually large, and the business, with all its uncertainties, seems to have been fairly profitable. Putting away their boats, the "Water Witches" or the "Fish Hawks" would begin immediately counting out the catch, to be sold to the neighboring farmers who flocked to the water at the first news of the haul. When the last "lumber wagon," loaded to overflowing, had jolted away into the interior, the great net would be slowly wound up on a giant reel and left in the sun to dry while the watch again began his lookout for the disturbed water above another school. It was the simple organization of an off-shore fishery. The fish were both caught and used near the beach, and a few fishermen were beginning to risk their whole livelihood in the new and highly uncertain vocation.

Discovery of Value of Menhaden for Production of Oil

The middle of the nineteenth century brought a change to the menhaden fishery. For some time, a few people interested in the business had been trying with indifferent results to extract oil from the "bunkers" by boiling them in whaler's "try-pots." In 1850, however, Mr. D. D. Wells built near Greenport, Long Island, the first menhaden oil factory on the Atlantic shore. Great success did not immediately attend this venture, for the product was of a dark color and had a very offensive odor. Persistent efforts, however, on the part of Mr. Wells in improving his machinery soon developed an oil that began to come into general use for painting and tanning and for the adulteration of other, more expensive oils. The refuse, "scrap" as it was called, was also utilized. By a process of drying and pulverizing it was made into a fertilizer and distributed among the farmers of the Eastern

States as "guano." The new uses for the menhaden products brought an end to the "agricultural" phase of the fishery. Such inroads were made in his supply that the farmer, finding so many of his fish diverted to other purposes and the "guano" too expensive for universal use, was compelled to bestir himself to a search for other sources whence fertilizer might be derived. The high prices of the Civil War period brought prosperity and also many competitors to the Wells enterprise. Instead of one nearly a score of small "factories" began to consume the catches made by the fishing companies. The oil business, however, was promptly overdone. The resulting elimination of the less fit speedily reduced the number of Long Island enterprises to ten. Built on out-of-the-way stretches of the beach, where their pungent odor would offend as few as possible, these crude establishments, scarcely more ambitious than the "headquarters" of the "Coots" or the "Water Witches," began to employ a considerable number of people and to stimulate the "bringing up of a hardy race of boatmen and sailors." The factory did not at first absorb the older fish companies but attracted new people to the shore. It was the measure of the increasing influence of the sea.

Change from Off-Shore to Deep-Sea Fishery

By the middle of the nineteenth century another change in the menhaden fishery had begun to manifest itself. Fifty years of uninterrupted capture had made the "mossbunker" wary, and schools came less frequently to the shallow waters of the coast. The catches of the seining companies became fewer and fewer. As a consequence the fishermen began to seek the fish farther out. Sloops and schooners of sometimes twenty tons swept the waters of Gardiner's Bay, Long Island Sound, and beyond. Because the new style of fishing required a new equipment the purse net was developed. When a fishing schooner sighted a school, two open rowboats would put off and swiftly lay the net in a circle about the fish. While the top of this floated at the water's surface, the bottom edge would be quickly "shirred" together with the long ropes intended for that purpose until the "bunkers" found themselves enclosed on every side. The vessel would then tack alongside and, with a scoop net, the catch would be transferred to the great storage tank in the boat. Although some of the old seining companies remained, the day of their importance was passing, and the more energetic among them abandoned the beach for the new style of fishing on the broad ocean. Menhaden fishing, which had called many men to a new occupation at the water's edge, was now steadily drawing many of these out to the open water as the business shifted from an off-shore to a deep-sea fishery.

The Disappearance of the Independent Fisherman

The advent of the oil factory came just at this time of change. The factory, because it was an outgrowth of a fishery already established, sent at first no fleet of its own to sea but was content to buy at its docks the catch of the fishing companies and crews already in the business. In this sense the first factories were dependent upon the fishermen. To ensure as steady and as large a supply of "bunkers" as possible some owners developed "floating factories," hulls of old ships remodeled and equipped with the requisite apparatus. These could be towed up and down the shore, saving time and expense by following the movements of the fish. The primitive floating factory, an adaptation to the off-shore phase of the fishery, was, however, but temporary. It disappeared with the disappearance of the fishing in shallow water. As the floating factory dropped out, its competitors on the beach grew in size and number. It was inevitable that the owners of these should begin to chafe at their dependence upon the fishermen, over whom they had no control. As the organization of the business required the manufacturers to compete with one another in buying "bunkers" for their presses, it was but natural that the more energetic among them should take steps looking toward the catching of their own fish. Within fifteen years after the founding of Mr. Wells's first establishment, a majority of the oil-making companies were sending their own fleets to sea, with orders to push their prows southward far down the coast and to follow the great menhaden schools in their migration to northern waters. With this change practically came the disappearance of the independent fisherman. He now became one of many elements in an organization steadily growing larger and more complex.

The "Factory" Phase of the Fishery

During the first three decades of the "factory" phase of the menhaden business a multitude of small oil-making establishments, costing from $10,000 to $40,000, appeared along the north Atlantic shore. By 1877 the coast of Maine could boast fourteen factories of sufficient importance to be represented in the Maine Oil and Guano Association. Narragansett Bay supported thirteen concerns, of which nine were located at Tiverton. Farther to the west, five more dotted the Connecticut shore. Another five prosecuted their business on the Jersey coast at Somer's Point and Tuckerton. Four factories were scattered along the Chesapeake from Norfolk to Baltimore. Even at this time, however, when the business reached its greatest regional expansion, Long Island, with its multitude of shallow bays and sheltered harbors, was the most important center. The first ten factories of the pioneers had increased to fifteen on the beaches of the eastern end, with eight more on those of the southern shore. Although, here and there, an isolated plant could be found, the bulk of the Long Island establishments were claimed by three centers, Barren Island in Jamaica Bay, Sayville on Great South Bay, and, most important of all, Greenport and Shelter Island on Peconic Bay.

Change from Sailing Vessels to Steamers

During the period of multiplication of small factories occurred a change which was destined to alter profoundly the development of the industry. The steady decrease of the number of schools coming into the off-shore waters and the consequent constant lengthening of the voyages down the coast overtaxed the powers of the sailing vessels. The amount of labor required and the speed with which a very perishable product must be brought to the factory from more and more distant fishing grounds were the factors that inexorably marked out the limits of usefulness of the sailing ship. Fish must be brought from grounds scores of miles from the factory and must not be allowed to spoil. The advent of steam was inevitable. The change, however, would cause nothing less than a revolution in the industry. The small oil manufacturer of the seventies could rarely afford to purchase and maintain a menhaden steamer, which, in many cases, would cost more than his entire factory. He usually had neither the capital nor the volume of business to warrant the purchase. The exigencies of deep-sea fishing, however, could not be avoided. The steamer was forced upon him. The result was consolidation of the factories. By 1895 the sailing vessel had been practically driven from the water, and the twenty-three Long Island factories of 1877 had been reduced to eight. Some of these were still located on Barren Island and the rest at a new center, the treeless isthmus of Promised Land. These larger concerns, with their improved equipment and fleets of small steamers, marked the beginning of the phase of the menhaden fishery characterized by highly intelligent adaptation to the peculiarities of the environment. Instead of waiting for the fish to come to the shallow waters of the shore, eager mariners drove their vessels farther and farther to the south whence the northern migration began. Every stretch of water where any menhaden might be found was carefully scanned again and again. The sea had not only drawn the fisherman far out from land but had completely changed his method of work. The movement toward consolidation fostered by the demands of the new deep-sea fishing was, however, not yet completed.

The Consolidation of the Industry

On the morning of November 19, 1897, when the people of Greenport picked up their local paper, those interested in the menhaden fishery were dismayed to read the following announcement,[4] which came without the slightest warning:

> A syndicate composed of English capitalists is negotiating for the purchase of the menhaden business at Promised Land. It proposes to buy the factories and the entire outfit, thus securing entire control of the menhaden business on eastern Long Island, and not only does this syndicate hope to obtain control of the Promised Land works, but it has also negotiated for the purchase of the National Oil and Guano Manufacturing Company, which has an office at Maiden Lane, New York, and is regarded as one of the most influential in the business. In fact, it is believed that the syndicate proposes to corner the entire menhaden business of the Atlantic coast. The capitalists have offered the owners of the factories the privilege of selling out their business to the syndicate at a fair price or else run the risk of being frozen out, as they claim this will ultimately come, in due course of time. If the owners of the factories will not sell, the capitalists will then undertake the process of freezing out the individual owners. In

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[4] *The Long Island Traveler*, Nov. 19, 1897.

order to do that they will secure a desirable harbor frontage, in the vicinity of the present factories, and then proceed to business. The capitalists claim to control a patent by which they can manufacture menhaden fertilizer with one third less expense than is incurred according to the present method. In this manner they propose to freeze out the present owners, if they will not sell.

This sudden assault upon the prosperous menhaden business brought consternation to the people. Disquieting rumors ran from village to village along the coast. "Fishermen are asking what the syndicate is. Is it the Standard Oil Company, the sugar trust, or an English syndicate?" Would the Maine and Rhode Island factories sell out? Families whose support depended upon the business became fearful that, in the event of a change, things might not fare well with them. Deep indignation at the cold-blooded attack appeared in every quarter. Behind closed doors the factory owners considered the situation in all its aspects. They understood that they were face to face with a corporation whose capital was reported at ten millions of dollars and which was armed with an invention that would enable it to undersell the most efficient of the local manufacturers. It was intimated to them, that, in the new concern, American as well as British money was involved and that the Standard Oil Company, wishing to turn certain of its waste products into a profitable lubricating grease by the addition of cheap menhaden oil, was the American firm interested. From November until February the owners considered the proposal. On the twenty-fifth of the latter month all the important concerns yielded to the inevitable, and, on that day, was consummated the final transfer of their properties to the American Fisheries Company. Together with those of Long Island went practically all the factories of the Atlantic coast. With this event the movement toward consolidation which had begun far back in the seventies reached its dramatic culmination.

Concentration of the Menhaden Oil Industry on Long Island

The problem which, at the outset, confronted the American Fisheries Company was of a distinctly geographical nature. Where should the large, new factories of the concern be located? The dominant factor in the problem was the annual migration of the menhaden schools from the warm waters of the Gulf region up the Atlantic coast as far as Maine, a great north-flowing river of fish running roughly parallel to the Gulf Stream. The company decided to establish four oil-making centers from which steamers could be sent out to tap this living stream. Delaware Bay, at the south, Promised Land and Tiverton in the center, and the coast of Maine at the north were the locations chosen. Besides these, an experimental factory was to be established on the Texas coast to try the possibilities of winter fishing in the Gulf of Mexico. Apparently because of its central location and its nearness to New York, Promised Land was chosen for the headquarters of the company. The winter quarters for the fleet were sometimes at Greenport and sometimes at Tiverton across the Sound. The new company abolished competition. Frequent long voyages, the purpose of which was to outdo rivals, were no longer necessary. The concern arranged its plants so that the river of fish could be divided into three segments, the northern, the middle, and the southern. Factories were located with reference to these divisions. The small factories that had succumbed gave way to large plants, and highly improved steamers brought a greatly increased catch to the storage tanks on shore. It was the last step in intelligent adaptation to the peculiarities of the maritime environment. The only question was whether the supply of menhaden would hold out in the face of such enormous inroads.

The reasons which had led to the concentration of the great menhaden oil business of Long Island into one small locality at Promised Land were significant of certain important developments in the life of the island. In the days of the early oil factories establishments had been scattered at irregular intervals along the whole shore from Greenport to Jamaica Bay to utilize the fish which came to all those waters. By 1890 most of these concerns had moved to Promised Land in the east and Barren Island in the west. After the coming of the American Fisheries Company the Barren Island factories were given up, and the whole Long Island business was carried on at the eastern station. There was another reason for this change, aside from the shifting of the fishery to the deep sea. An exceedingly offensive odor of decaying fish arises inevitably from the menhaden manufacturing establishment. Unpleasant as this was, the factory of the early days, built on an out-of-the-way part of the beach, was allowed to stay because many of the men and women of the locality were dependent upon it for their living. When, however, the summer people of New York began to come to the beaches of Long Island in sufficient number to make them valuable, the situation was changed and a struggle was precipitated between the factory owner and the inn keeper. First to feel the new influence was beautiful Shelter Island, from whose beaches the factories were expelled as early as 1872 by the strong arm of the law, acting avowedly in defense of public health. The story of Shelter Island was that of the whole Long Island coast. Everywhere health officials began closing down or driving out the factories as fast as the local inhabitants entered into the business of caring for the vacation people from the city. The question presented to the factory owner was where to go. Promised Land, a narrow bleak isthmus of sand with the sea pounding at either side, a land of no farms, no villages, and no summer people, offered a safe retreat and refuge. Attractive from its very unattractiveness, set far out upon the Montauk peninsula, near which flows the great menhaden stream, a railroad skirting its beach of sand dunes and finding a terminus a scant hundred miles away in the greatest industrial center in America, Promised Land formed the ideal location for the maker of fish oil. To this center ultimately gravitated the whole of Long Island's great business, and here the American Fisheries Company established headquarters. At least one section of the "Long Island barrens" had come into its own.

Conclusion

The menhaden fishery is relatively unknown. It has little of the romance of whaling, and it requires little of the hardihood demanded in the quest for cod off the Newfoundland Banks. There is scant material in this business of the sea with which to stir the imagination, yet the story of the development of this fishery is not without value. The shore line is the greatest boundary line in the world and the coast area the world's greatest zone of transition. Perhaps this story of the development of an obscure fishery which does not consider the sea in its more famous rôles of the great barrier, the busy highway of commerce, or the source of almost limitless food supply will serve to point out the multiplicity of ways in which the ocean influences the life of the shore dweller and the silent power of that influence when once it begins to operate. Most people think of the coast line from the Gulf of Mexico to the Gulf of St. Lawrence as the eastern edge of the United States and fail to realize that it is also the western rim of the Atlantic Ocean. It is the middle zone between the two, typical of neither, and the life of its people is the resultant of the interplay of the two greatest natural forces that the world knows.

THE ZOÖGEOGRAPHY OF NORTHWESTERNMOST SOUTH AMERICA (AFTER CHAPMAN)

By CHARLES C. ADAMS
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Modern botany and zoölogy, in their emphasis on ecology, or the environmental relation, rather than on the taxonomy, or classification, stressed by the older school of thought, closely approach the geographical viewpoint. Works composed from this standpoint therefore generally afford much of value and interest to the geographer. One of the most noteworthy among recent publications of this kind is Chapman's "Distribution of Bird Life in Colombia."[1] It is a report on an unusual biological survey—unusual, because its purpose, as the author states, was not to find new species of birds but mainly "the discovery of the geographic origin of South American life." The collections upon which the study is based were secured during a period of more than four years by expeditions from the American Museum of Natural History which were confined to the Andean region of Colombia.

The detailed notes on Colombian birds which form the bulk of the work (Part II, pp. 170–639) are preceded by introductory chapters illustrated by well-chosen photographs and maps (Part I, pp. 3–169). These chapters contain a review of the status of knowledge of Colombian ornithology, a general description of the routes followed on the Museum's eight expeditions, a summary of the topography, climate, and vegetation of the region, and—the culmination of the investigation—a discussion of the distribution of animal life in vertical "life zones" and its relation to the problem of the origin of South American life. This discussion, which consists of two parts, general conclusions (pp. 84–93) and individual characterizations of each life zone (pp. 93–169), is illustrated by the two colored maps which are reproduced in black and white herewith (Figs. 1 and 2).

The Vegetational Areas

Vegetation is recognized as the primary factor in animal distribution. Four types are distinguished, as follows (Fig. 1): mountain forests; tropical zone forests; unforested areas; and llanos. The dense tropical forests are clearly determined in the main by the low altitude, high temperature, and heavy rainfall. The lowland open areas are due to drought. The llanos are covered with tall grasses and scattered bushes and extend as strips along streams subject to much overflow. The arid regions of the upper valleys of the Magdalena and Cauca Rivers are, according to Hettner, due in part to a porous soil, to drought, and to high temperature. The upper Cauca valley has probably been cleared considerably. The mountain forests are

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[1] F. M. Chapman: The Distribution of Bird-Life in Colombia: A Contribution to a Biological Survey of South America, *Bull. Amer. Museum of Nat. Hist.*, Vol. 36, 1917, pp. 1–729.

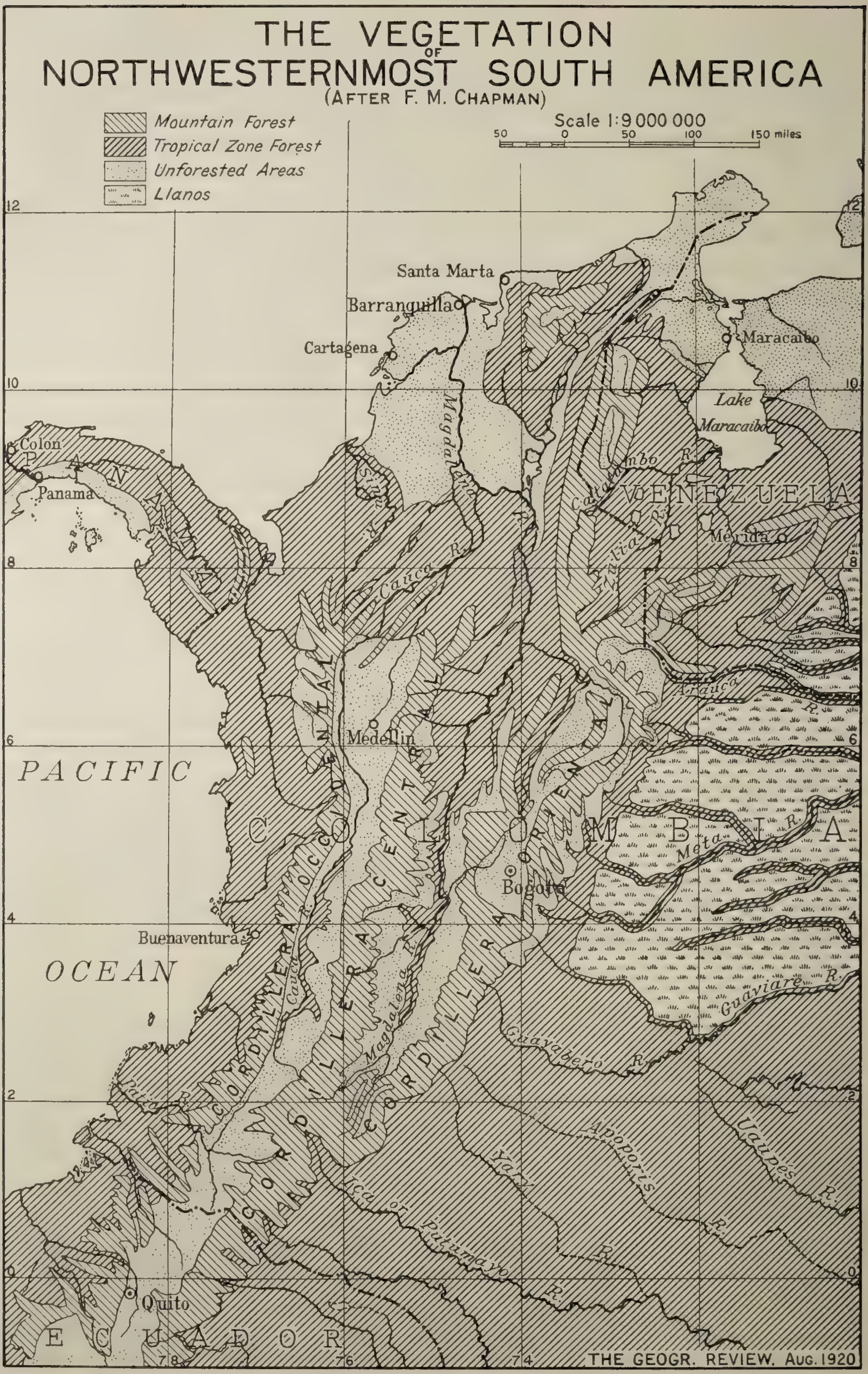

FIG. 1—(Sierra de Perijá region modified after de Booy)

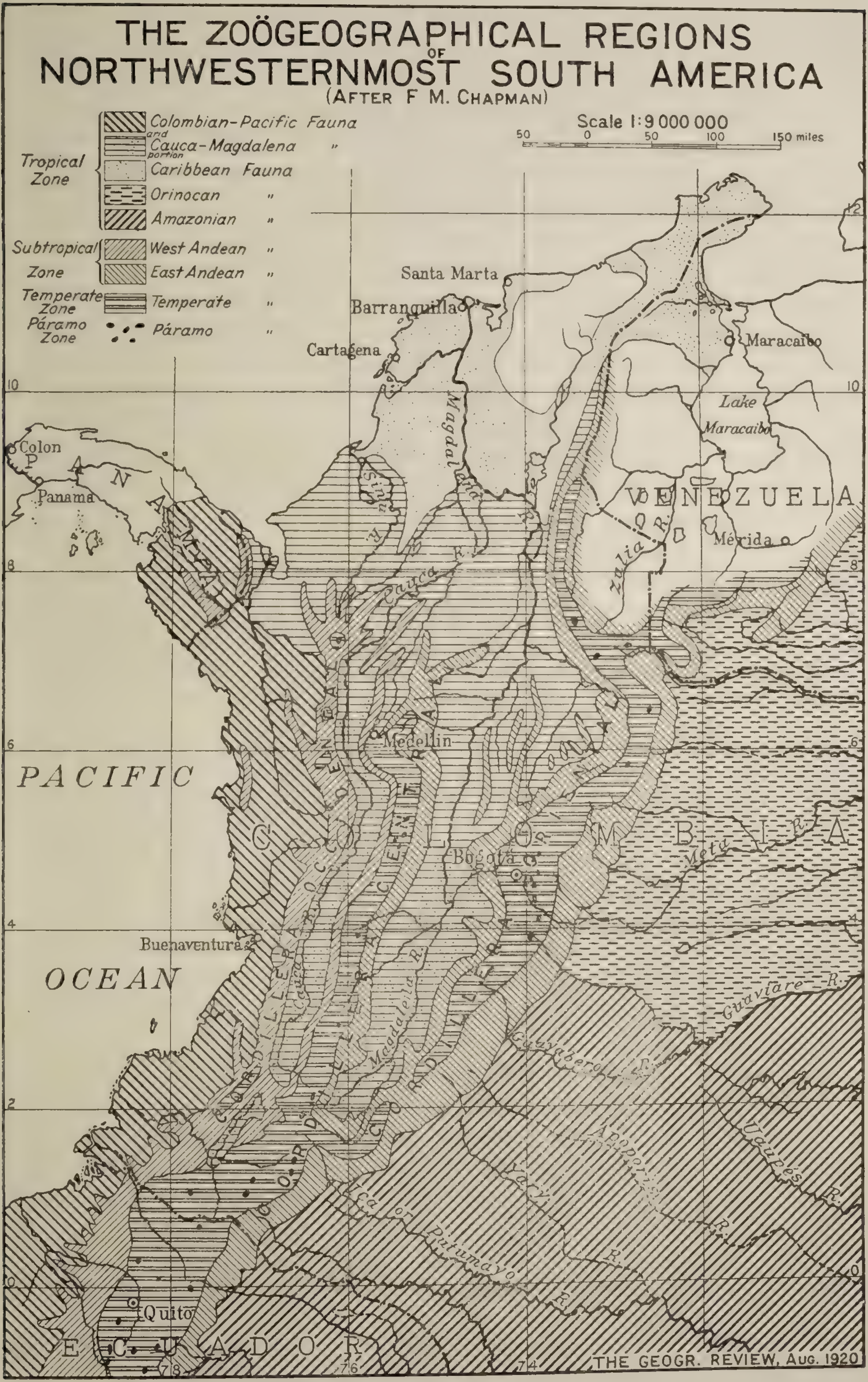
THE ZOÖGEOGRAPHICAL REGIONS OF NORTHWESTERNMOST SOUTH AMERICA
(AFTER F M. CHAPMAN)
Tropical Zone
Colombian-Pacific Fauna
and Cauca-Magdalena portion
Caribbean Fauna
Orinocan "
Amazonian "
Subtropical Zone
West Andean "
East Andean "
Temperate Zone
Temperate "
Páramo Zone
Páramo "
Scale 1:9 000 000
50 0 50 100 150 miles
Santa Marta
Barranquilla
Cartagena
Maracaibo
Lake Maracaibo
VENEZUELA
Mérida
Zulia R.
Colon
Panama
P A N A M A
Sinú R.
Magdalena R.
Cauca R.
Medellin
Bogotá
Meta R.
PACIFIC
OCEAN
Buenaventura
C O L O M B I A
CORDILLERA OCCIDENTAL
CORDILLERA CENTRAL
CORDILLERA ORIENTAL
Cauca R.
Magdalena R.
Guaviare R.
Guayabero R.
Apoporis R.
Uaupés R.
Yarí R.
Caquetá R.
Putumayo R.
Quito
E C U A D O R
10
8
6
4
2
0
78
76
74
12
THE GEOGR. REVIEW, AUG. 1920

Fig. 2

subtropical and temperate in character and are cloud forests, their lower limit being determined by the altitude at which condensation takes place, while the upper limit of the temperate belt is coincident with the timber line.[2] The subtropical forests lie apparently between 5,000 and 9,500 feet. The lower forest is more continuous than the upper. The unforested mountains above the tropical zone are savana areas in the temperate zone, as also are those which extend above the temperate forests.

DISTINCTNESS OF THE LIFE ZONE BOUNDARIES

The discussion of the life, or faunal, zones of the Colombian Andes leads quickly to Chapman's main geographic interest and his main problem. He states: "That the altitudinal distribution of plants should conform closely to belts or zones, the limits of which are determined primarily by temperature, is not surprising; but that such mobile creatures as birds should be confined within certain more or less definite boundaries by these invisible barriers is a convincing evidence of their potency as well as of the sensitiveness of the organisms on which they act (p. 84) . . . . No one can stand at the foot of a snow-crowned mountain in the tropics without at once realizing that temperature, as it is influenced by altitude, is obviously the dominant factor in producing the floras and faunas encountered between base and summit. Where humidity, and in certain instances, character of the soil add their influence, the boundary lines between life zones are often very sharply defined. One may pass, for example, from the upper border of the arid tropics on the eastern slope of the Western Andes at San Antonio into the dense forests of the humid subtropics on their crest in less than two minutes and experience a complete change in bird life. But even where temperature alone is active, and there is no marked difference in rainfall, the forest being continuous, an altitudinal difference of 1,000 feet may bring one into an essentially new avifauna" (p. 84). "Even the condor, a sea-level bird of Patagonia, makes what we think of as his true home on the summits of the Northern Andes, where the factors which determine zonal boundaries keep him to his true level quite as effectively as they do a diminutive marsh wren" (p. 167).

ORIGIN OF THE PRESENT DISTRIBUTION OF ANIMAL LIFE

The birds show a distribution in four vertical life zones, as follows: tropical zone, sea level to 4,500–6,000 feet; subtropical, from 4,500–6,000 feet to 9,000–9,500 feet; temperate, from 9,000–9,500 to 11,000–13,000 feet; *páramo* (treeless), from 11,000–13,000 to snow line at 15,000 feet (Fig. 2). These zones are very similar to those recognized by students of plants. In order to explain these conditions Chapman makes a very significant remark, as follows: "Any attempt to explain existing conditions must be preceded by an effort to picture to ourselves the effect on the fauna of a tropical region of the uplift in it of a mountain system to snow line (p. 87) . . . . Where such an uplift created a mountain system as continuous as the Andes now are, these new areas were doubtless populated by latitudinal extension of range from regions having similar climates, and by altitudinal extension as the pressure of life from immediately contiguous regions below forced species upward, the more adaptable of which survived" (p. 88). He then considers successively the influence of elevation, glaciation, and subsidence. The Andean uplift, geologists believe, took place in the Tertiary, with additional uplift in the Pleistocene. With this background it is significant to note how these conditions have influenced the birds. Chapman remarks that the subtropical birds have been derived "almost wholly" from the zone below; the temperate from the subtropical, in part, as well as elsewhere from the same zone at sea level, "while nearly all those of the *páramo* zone have come from the sea level equivalent of this zone in southern South America. It follows, then, that the birds of every zone above the tropics have been derived from a lower level. There are some exceptions to this rule, but they do not affect the general truth of the statement. In comparative variability the fauna of the subtropics differs more from the ancestral stock in the tropics than do the altitudinal forms of the temperate and *páramo* zones from their distant sea-level derivatives of the south temperate zone, with which indeed they are often specifically identical. Hence it follows that uniformity of life increases with altitude while, as a corollary, the number of species decreases; uniformity of environment being apparently the underlying cause" (p. 88). These are indeed very important conclusions which should interest every geographer and student of earth history. They are probably the most important discoveries of the whole study.

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[2] Some geographers and biologists do not seem familiar with recent ideas as to the causes of the timber line on mountains, so that reference is here made to the studies on this subject by Cowles and by Shaw (see *Amer. Naturalist*, Vol. 43, 1909, pp. 420–431; *Plant World*, Vol. 12, 1909, pp. 1–15); *Ecology*, Vol. 1, 1920, p. 71.

It would be well worth while to apply these same methods to other parts of the world and to formulate a world-wide view of these biogeographic relations. The preceding quotation also suggests that the importance of habitat relations is even greater than the present study elaborates and shows that the relation of habitats to life zones is a subject worthy of detailed investigation.[3] The kinds of birds decrease with altitude, in harmony with their simpler physical habitat. Chapman recognizes what he considers to be a Pacific coast pre-Andean tropical fauna (p. 89). On account of the former greater glacial activity on the Andes, he suggests that "existing zonal boundaries are post-glacial." As illustrating the influence of subsidence he cites the very interesting discontinuity of range of certain relatively sedentary subtropical birds occupying the mountains of Costa Rica and of

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[3] See Chas. C. Adams: Baseleveling and Its Faunal Significance, with Illustrations from Southeastern United States, *Amer. Naturalist*, Vol. 35, 1901, pp. 839–852.

Idem: Migration as a Factor in Evolution: Its Ecological Dynamics, *ibid.*, Vol. 52, 1918, pp. 465–490; Vol. 53, 1919, pp. 55–78.

Idem: An Outline of the Relations of Animals to Their Inland Environments, *Bull. Illinois State Laboratory of Nat. Hist.*, Vol. 11, 1915, pp. 1–32.

A. G. Ruthven: An Interpretation of the Distribution of the Reptiles in Maggie Basin, Nevada, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 948–952.

Colombia, these birds being absent in the intervening lowlands of Panama, where subsidence is inferred. In concluding his discussion of the factors which influence life zones no mention is made of the vegetation, although elsewhere he repeatedly points out its influence upon birds. In fact in several particulars the logical development of his general discussion is not well worked out, and he does not seem to have been interested in the recent valuable methods of geographical description developed by W. M. Davis.

The Pacific coast tropical zone is quite unusual in many respects. It possesses great diversity in habitats, is very humid, and has been the main center of origin for Colombian birds. Finally, it is more strongly characterized than any other equal area of tropical South America, having about 150 species and subspecies. This is a very remarkable condition for a continental land mass. The relation of this fauna to that of the Amazon is also a distinctive feature, an affinity also shown by the Pacific-slope freshwater fishes. There is evidence that one of the latest trans-Andean lines of faunal communication was in southern Ecuador. Another very significant geographical relation is shown in the Cauca valley, where but few kinds of birds are peculiar to the region. This fact suggested to Chapman that its fauna was a new one, and he suspected that the valley was the bed of an extinct lake. This idea is supported by White's geological evidence of a post-Tertiary lake in this valley caused by a volcanic dam.

In brief we may look upon the geographic origin of the bird fauna somewhat as follows: An elongated mountain range became elevated in the midst of a tropical region with a widely distributed Amazonian fauna and divided it. The Colombian Pacific tropical zone has now developed one of the most distinctive faunas found in the tropics on a continental land mass. As the mountains arose to a subtropical level a subtropical fauna was developed or evolved from the faunal stratum below. A part of this fauna was possibly destroyed by a depression in the Panama region, and a break in the continuity of range was made between the Colombian and the Costa Rican subtropical faunas, which at no point reached sea level. As the mountains continued to rise above the subtropical stratum and temperate conditions were developed, a direct continuity was established along the Andes (to the south) with the cooler lands near sea level, and a fauna migrated northward along the axis or backbone of the South American continent and mingled with that formed in place; later, as the alpine heights were reached, other invaders came from far south where they had been able to live at sea level. These alpine conditions were distinctly favorable during the period of alpine glaciers.

Conclusion

The many interesting and detailed distributional facts upon which these conclusions are based are discussed fully in pages 93–169, with tabulations and maps. The great bulk of the volume, as stated above, is devoted to the detailed notes on the numerous species of birds, and these notes are accompanied by several colored plates. A gazetteer of collecting stations (pp. 640–656) contains information which is likely to be of value to many geographers as well as to bird students.

No one can read such an important and interesting volume without feeling the fascination of the problem and without hoping that the author may be permitted to extend his studies throughout the Andes. It may also be added that this is perhaps Dr. Chapman's most important contribution to zoölogy and to geography and will long remain a fine model for other students. Other naturalists and geographers will now become interested in testing his ideas. The bird population did not execute these migrations alone. The birds are dependent upon certain vegetational conditions and certain kinds of animal foods; and at the same time they would be followed by a predatory company, so that a whole biotic association must have traveled together and may be expected to furnish independent converging evidence on the origin of the South American fauna.

GEOGRAPHICAL RECORD

NORTH AMERICA

A Rune Stone in Minnesota as a Possible Indication of a Norse Expedition in 1362. The imprimatur of the Wisconsin Historical Society upon an article reprinted from the *Wisconsin Magazine of History* (Vol. 3, No. 2, December, 1919), entitled "The Kensington Rune Stone: Is It the Oldest Native Document of American History?" by H. R. Holand, justifies one in expecting a substantial contribution. And we are not disappointed in the argument and conclusions of the author of this extremely interesting analysis.

The subject of the paper is most unusual. There was found in 1898 at Kensington (a Minnesota village situated in the belt where the great coniferous forest of the North gives way to the open grassland of the Great Plains) a slab of stone 30 inches long, 17 inches wide, and 7 inches thick, and weighing about 230 pounds, the face and one side of which for three-fifths of its length are covered by an inscription in Runic characters. The stone was found under the stump of a tree whose roots embraced it securely. When the characters were deciphered the following inscription was made out:

> Eight Goths [i.e. natives of Gothland, Sweden] and twenty-two Norsemen on exploration-journey from Vinland through the western regions. We had camp by two skerries one day's journey north from this stone. We were [out] and fished one day. When we came home [we] found ten men, red with blood and dead. Ave Maria! Save [us] from evil!
>
> [We] have ten of our party by the sea to look after [or for] our vessels 14 days' journey from this island. Year 1362.

The inference from the inscription is that Norsemen conducted an expedition to the middle of the continent in 1362, and the argument of the author is devoted to a review of the previous discussions—some of which considered the stone as a forgery—and to an analysis of the historical and linguistic probabilities. The attitude of the author is conservative. He argues for the authenticity of the inscription on five principal grounds:

> (1) The position of the stone *in situ* and the practical impossibility of its having been placed in position by a man of eminent runic, linguistic, and historical accomplishments 100 miles from the nearest habitation in an unsettled wilderness.
>
> (2) The weathered appearance of the stone, showing that it had not been recently engraved.
>
> (3) The interpretation of the 14 days' journey in terms of the Norse idea of a "day's journey," which meant not a day on foot but the distance covered in a day's sail with a fair wind. Taking this to mean about 80 miles, the 14 days would be equivalent to 1120 miles, or approximately the distance from Hudson Bay to Kensington if allowance be made for a winding course.
>
> (4) The numerals, which long mystified students and which were not properly interpreted until 1909, when Helge Gjessing, a philologist of Christiania, showed that the numerals were "in perfect accord with runic numerals used in the Middle Ages."
>
> (5) The use of "Ave Maria! Save from evil!" which, written in part in Latin characters and with this peculiar wording, seems to show that it was written in the Middle Ages.

Mr. Holand concludes that these arguments, when considered together, leave little doubt that we have in the inscription an actual and important record dating from the fourteenth century. "It seems obvious that it would be impossible for a present-day forger to construct an inscription of such length and multiplicity of ideas without leaving indubitable proof of his forgery. Particularly would this be true of an inscription purporting to date from the fourteenth century, which is a peculiarly difficult period linguistically, runologically, and historically. The multitude of errors which critics have made in reviewing the inscription shows the difficulties any one of these men would have encountered if he had attempted to invent such an inscription. Yet this inscription, coming from an uninhabited wilderness, has survived all attacks made upon it for more than twenty years.

"In view of this and in view of the great significance of its message, it is surely time for our learned societies and institutions to cease their 'waiting and watching' attitude and take energetic action in thoroughly investigating the subject."

A New Snowfall Map of the United States. In 1913 Dr. Charles F. Brooks published an average annual snowfall map of the United States based on observations made at about 2,000 stations during the fifteen winters from 1895 to 1910 ("The Snowfall of the United States," *Quart. Journ. Royal Meteorol. Soc.*, Vol. 39, 1913, pp. 81–84, Pl. 2). This map has recently been reprinted in this country (R. DeC. Ward: The Snowfall of the United States, *Scientific Monthly*, Vol. 9, 1919, pp. 397–415). In the case of earlier maps the observations which were used came mostly from near sea level, and for that reason the heavy snowfalls on the mountains and at the higher elevations generally were not indicated. In Dr. Brooks's map use was made of observations obtained at the higher altitude as well as the lower. Topographic effects were also taken into account, and the map therefore showed, for the first time, the actual conditions of snowfall over the whole country with as close an approach to accuracy as was possible with the available data.

In the *Monthly Weather Review*, Vol. 47, 1919, Chart XVII, there is now published a new map of the average annual snowfall of the United States, originally prepared by J. B. Kincer of the Weather Bureau from all available records in the Western mountains and from the complete records east of the Rockies for the period 1895–1914. The map was then revised somewhat by Dr. Charles F. Brooks in order to bring it into conformity with certain obvious topographic influences, as well as with the previously published detailed map for the region east of the Mississippi, 1895–1913 (C. F. Brooks: The Snowfall of the Eastern United States, *Monthly Weather Rev.*, Vol. 43, 1915, pp. 2–11, Pl. 43), and of New England, 1895–1916 (C. F. Brooks: New England Snowfall, *ibid.*, Vol. 45, 1917, pp. 271–285, Fig. 30, on p. 285). The basic averages for the 20-year period of Kincer's original map have, however, been retained. The new map shows depths of snowfall for 0, 1, 5, 10 inches, and then for every 10 inches up to 60 inches.

The most striking points of difference between the Brooks map of 1913 and the modified Kincer map of 1919 concern the lines indicating the heaviest annual snowfalls. In Dr. Brooks's map lines showing depths of 100, 200, 300, and over 400 inches were drawn over portions of the Sierra Nevada and the Cascade Range, while lines showing amounts of over 100 inches were shown over fairly large areas of the Rocky Mountain system even as far south as northern New Mexico, reaching over 300 inches in southern Wyoming and 400 inches in parts of the Colorado Rockies.

On the map constructed by Kincer no amounts of over 60 inches are indicated by lines over any portion of the western United States, depths in excess of 60 inches being shown in figures. Thus, an observation of 527 inches is indicated over the central Sierra Nevada, this being the maximum snowfall shown anywhere on the map. Further, 459 inches are shown over the northern Cascades, in Washington; and 430 inches over the Cascades of Oregon. In the Rocky Mountain area a maximum depth of 337 inches is shown in the mountains on the Colorado-New Mexico border; of 298 inches in north-central Colorado, and of 250 inches close to the Idaho-northeastern Oregon line.

Over the eastern United States the two maps are naturally much more alike, because the annual depths of snowfall exceed 60 inches only over relatively small areas. The new map emphasizes somewhat more clearly the topographic effects of the northern portions of the Appalachian Mountains, especially in West Virginia and in New England. Both maps agree in showing annual snowfalls of over 100 inches in northern New England, at the eastern end of Lake Ontario, and along the Lake Superior shores of the northern peninsula of Michigan. The lines of equal depth of snowfall up to 400 inches, on Dr. Brooks's map, thus inevitably bring out very emphatically the heavy snowfall on the Western mountains, whereas the new Kincer map shows depths greater than 60 inches in the West only by printing the figures for scattered points. The latter method adheres more rigidly to the actual observations and allows less latitude to the individual judgment in interpolating the probable effects of topography. The former thus brings out more clearly the heavier snowfalls on the mountains; the latter is more strictly accurate.

R. DeC. Ward

AFRICA

Eolian Denudation in Relation to the Diamond Deposits of the Southwest African Protectorate. The prosperity of former German Southwest Africa was based upon the diamond discoveries of 1908. Diamonds formed the bulk of the exports of the colony—80 per cent in the year preceding the war—and constituted its chief source of revenue. The occurrence of the diamond here presents problems in economic geology whose interest has been generally heightened by the late change in administration. A brief discussion of the controlling physical conditions has recently been given by R. F. Rand in the paper "Angra Pequena (Lüderitzbucht) and Subaerial Denudation" (*Geol. Mag.*, January, 1920, pp. 32–35).

The Southwest African diamonds are found in a coastal strip extending from Conception Bay, 100 miles south of Swakopmund, to a point some 60 miles north of the mouth of the Orange River, the richest fields being south and east of Lüderitzbucht (the Angra Pequeña of Bartolomeo Diaz). No diamonds have been found at a distance of more than 15 miles from the sea. Within this area the stones are found for the most part in the gravels flooring the broad, dry valleys. Their distribution is controlled by the prevailing south-southwest wind, which in the summer months blows almost daily with hurricane force. The wind appears to be purely coastal and to occupy only a shallow stratum of the atmosphere. Within its limited range, however, extraordinary effects of eolian denudation are accomplished in this desert terrain—effects well described by Harger in "The Denudation of the South African Continent" (*Trans. and Proc. Geol. Soc. of South Africa*, Vol. 16, 1913).

The topography of low ridges and rugged hills, the variable rock structure and composition afford ample scope for the carving of the fantastic forms that appear in the honeycombed and wind-bitten surfaces. The detrital material is accumulated in the broad-floored valleys and depressions in which the uppermost portion is lashed by the wind into "regular waves and miniature dunes." In the sifting process the diamonds and other heavy particles find their way to the surface and crests of the waves. Furthermore there is an enrichment on the windward side of obstacles and at the heads of valleys facing the direction of the wind.

Further responsibility attributed to the wind in the disposition of the diamonds is dependent on the origin credited to the diamonds. The primary source has been variously ascribed to the country rock; to a terrain in the interior either of the Protectorate or of the Union of South Africa whence the diamonds are carried down by the streams, in the latter by the Orange River and thence northward by the Benguela Current; to a submerged area off the coast. These several theories have been outlined by Wagner, who brings forward considerable evidence in favor of the last (P. A. Wagner: The Geology and Mineral Industry of South-west Africa, *Union of South Africa Geol. Survey Memoir No. 7*, Pretoria, 1916). Rand, however, "sees no reason why the enrichment should not have taken place from a landward area, and not necessarily from seawards" and thus that the south-southwest wind "may be entirely responsible for the denudation of the parent diamond-bearing rock as well as for the concentration of the diamonds after being set free." In this connection it may be remarked that the area in which the wind operates is approximately defined by the seaward limits of the aloe, *Aloe dichotoma*, an arborescent form which, common in the interior, is unable to stand the coastal wind.

AUSTRALASIA AND OCEANIA

The Adaptability of the White Man to the Tropics in Australia. The adaptability of the white man to the tropics is discussed more vigorously in Australia than almost anywhere else. The *Review* has commented (*Geogr. Rev.*, Vol. 4, 1917, pp. 401–403; Vol. 5, 1918, p. 86; Vol. 8, 1919, pp. 101–106) on the climographs of Taylor, which show how widely central and northern Australia depart from the climatic types best suited to the white man. A more favorable view is presented by Drs. A. Breinl and W. J. Young of the Australian Institute of Tropical Medicine at Townsville, Queensland (Tropical Australia and Its Settlement, *Annals of Tropical Medicine and Parasitology*, Vol. 13, No. 4, March 15, 1920, pp. 351–412). Their paper begins with a good section on the Australian climate in general and ends with an admirable section on life in northern Australia—the hot and stupidly built houses of galvanized iron, the great use of alcohol, the failure of many settlers to wear cool enough clothing and broad enough hats, the seasonal occupations, the migratory life, the high wages, and the hot season when "the least exertion causes profuse perspiration," and when, even at night, "although at rest with doors and windows wide open, one perspires freely and wakens up in the morning unrefreshed and more tired than one felt on going to bed."

Between these two geographical sections come two medical sections, one excellent, and one curiously inadequate and misleading. The excellent section discusses the changes in the physiology of the white race within the tropics and is worth summarizing.

(1) Body temperature. Same as elsewhere when at rest: essentially the same for all races. With exercise, however, the temperature rises more quickly than in cooler regions and falls more slowly. Much exercise has the same effect as a mild fever.

(2) Respiration. The rate is decidedly high, presumably to increase evaporation and thus reduce the body temperature. Abundant evidence indicates that evaporation from the lungs and skin has far more to do with the temperature of the body than has the amount of chemical activity.

(3) Blood pressure. No permanent change, but probably greater temporary variations after exercise.

(4) Blood conditions. Slight relative decrease in red corpuscles. The white corpuscles (leucocytes) not only increase in number but show more polymorphonuclear

neutrophile leucocytes among which a larger percentage have nuclei with only one or two instead of several fragments. The eosinophile leucocytes diminish. The exact significance of these conditions is not known, but our authors do not think them important. Except in disease there is no change in the specific gravity of the blood, and "the popular belief of the 'thinness of the blood' after prolonged residence in the tropics is, apart from anemia, due to disease, only a myth."

(5) Metabolism. Judging by the amount of food consumed, metabolism is as great in the tropics as elsewhere, but other evidence seems to show a zone of minimum metabolism near the optimum temperature, i.e. 60° to 70° F. As judged by the nitrogen in the urine there is a distinct tropical reduction in metabolism.

(6) Nervous system. Neurasthenia is undoubtedly common but may be partly due to other causes as well as climate.

(7) Clothing. A dark skin causes rapid heating and hence sweating and evaporation, thus cooling the body, but dark clothing has the opposite effect, for it merely holds the heat and prevents evaporation.

(8) Disease in general. Diseases are more common than elsewhere here because of (a) insects, (b) the weakening effect of heat, and (c) the unhygienic modes of life.

In the face of the evidence thus summarized the authors present a misleading section containing mortality tables. These appear to show that Queensland is the most healthy country in the world both for adults and for infants. In 1913 the general death rate is given as 10.4, against 10.8 for all of Australia, 12.3 for the Netherlands, 13.8 for England, and 14.1 for the registration area of the United States. These figures are worse than useless, for the population of Queensland, especially in the tropical parts, differs from that of an ordinary country in the following respects: (1) It is composed of settlers who are more energetic than the average of their countrymen. (2) It is largely migratory, and people who begin to feel the effect of the climate move away, so that their deaths are credited to some other region. (3) Most of the people are men from 20 to 40 years of age—ages at which the death rate is low. Women, who feel the tropical conditions more than men, are scarce. So, too, are old people, among whom, of course, the death rate is high, and young children, who feel a tropical climate most of all. (4) Indoor work in factories is very rare, but this is one of the great factors in raising the death rate in most of the countries that Breinl and Young use for comparison. (5) It is notorious that in a scattered, migratory population where physicians, clergymen, and officials are scarce and government is lax, a large number of deaths are not recorded even among highly civilized people.

The only proper way to determine the death rate in tropical Australia is to separate the population by age, sex, and occupation and then compare with a "standard" population. Even then allowance would have to be made for the migration of people who feel run down. Such a comparison would probably show a death rate at least double the 10.4 given by Breinl and Young. Ellsworth Huntington

Tropical Control of Australian Rainfall. The study of cirrus-cloud movements in relation to storm systems in Australia has led Mr. E. T. Quayle, who is supervising meteorologist of the Australian Commonwealth Bureau of Meteorology, to an investigation of the influence of tropical conditions upon the development and rainfall-production of storms in the temperate belt, and of the possibility of increasing the range and accuracy of the Australian rain forecasts ("Tropical Control of Australian Rainfall," *Commonwealth Bur. of Meteorol. Bull. No. 15*). The inland rains in Australia seem to be almost entirely dependent on drifts of air from lower latitudes, and it appears that the more directly these drifts take place in a southerly direction, the more abundant is the inland rainfall, assuming the rate of motion to be the same. The departures of the minimum temperature from normal were found to be the most available data for use in the endeavor to trace the origin of the inland rains. Graphical methods were employed for showing the relations between the temperature departures and the rainfall over several southern inland areas.

The results of this study have proved to be of the greatest value and have introduced a new, and most important, factor in rain forecasting. The conditions of the air in advance of and on the equatorial side of the path of disturbances which pass over the continent or along its southern coast line are the chief determining controls of the rainfalls which occur in connection with these disturbances. And, as the extent of this tropical influence can now be determined, by the method which is set forth in the present *Bulletin*, it has become possible to make the daily forecast more accurate as regards both the distribution and the amount of the rain which may be expected from each approaching storm. Thus, it appears that over the inland areas of South Australia and New South Wales, in winter, the rains are almost always preceded from one to two days by a marked rise of temperature over subtropical stations to the northwest. This rise is from 5° to 20° above normal and the greater the rise, the greater the rainfall. Further, the conditions in the subtropical belt are in their turn dependent upon the rain-producing influences in the adjacent tropical belt, and, as these tropical conditions change slowly, it becomes possible to forecast, some days in advance, whether the rains accompanying the disturbances passing over the southern districts will be heavier or lighter than the average. Years of heavy southern rainfalls frequently show a nearly direct north-south drift of tropical influences, while dry years show an excess of "streams of influence" from other directions. The neighborhood of New Guinea seems to give the first indication of most of the inland rains of Australia, with the possible exception of those of Western Australia.

Mr. Quayle's monograph is illustrated by means of curves and maps. The results of his study open up a new and interesting field for further research. The relation here established between the rains over southern Australia and tropical conditions may, as the author points out, be as important in other parts of the world as in Australia, although it may be less obvious in latitudes higher than those of southern Australia.

R. DeC. Ward

POLAR REGIONS

The Plant Food of the Smith Sound Eskimos. The *Geografisk Tidskrift*, the journal of the Royal Danish Geographical Society, in 1918 (Vol. 24, No. 8) published an interesting article by Peter Freuchen on the part which plants play as food in the domestic economy of the Smith Sound Eskimos—a minor geographical item which has never before been dealt with exhaustively. Naturally, Freuchen finds that plant food is no significant part of the Eskimo diet. The vegetation is too sparse to produce any considerable quantity of food, and, besides, the Eskimos have no way of preserving for winter use the little that might be collected in the short summer.

The commonest of all plant food used is the mass of slightly digested vegetable pulp in the paunch of the musk-ox and caribou, and this—called *neruvkarsuit* by the Eskimos—is considered a great delicacy among them. Especially is it highly prized when it is accompanied by *akutak*. *Akutak* is a mixture of equal parts of water, narwhal oil that has melted out of the blubber in sunshine, and musk-ox or caribou tallow, stirred together cold until it forms a light mass resembling beaten white of egg.

The plants which are used directly for food are ten or fifteen in number. The first flower which appears in the spring in Greenland is the purple saxifrage (*Saxifraga oppositifolia*). As soon as the snow melts down, this dainty little flower begins blooming, and in the course of a few days after the snow has left a bit of ground the plot becomes purple with its blossoms. Then it is no uncommon sight to see the Eskimo women and children go out with their little seal-skin cups and collect the flowers. These they eat much as children here eat red clover. Occasionally they mix the flowers with seal blubber; then the mixture is considered very good indeed.

The Arctic willow is used as food in several ways. Its newly opened green leaves are laid upon boiled meat, much as we use cress; also it is used in *iseqavik*, which is a mixture of half-rotted blubber, called *pujak*, with the willow down from the ripened willow catkins. The resulting mass is more like chewing gum than anything else, and the Eskimos use it as if it were. Caribou hunters who have to travel far overland like to keep chewing it all day long, because they say it keeps them from becoming hungry when they have nothing to eat.

One of the daintiest plants found in all North Greenland is *Silene acaulis*, a delicate little pink flower which grows in low round mats. Of this plant the Eskimos eat the root, which sometimes becomes as thick as a person's finger; more often it is only as thick as a lead pencil. When cooked carefully it tastes somewhat like carrots, and when made into soup, especially with whale blubber, it is very good.

The plant most used by the Eskimos is *Oxyria digyna*, a plant which tastes very much like sorrel. It grows almost everywhere in the North, and its red leaves and flower stems are visible for long distances. It tastes strongly of oxalic acid and because of its spicy sourness is particularly prized by the Eskimos as a dressing for meat. It is also eaten fresh just as it is gathered.

Two species of berries are found in the land, the "black" berry, or *Empetrum nigrum*, and the "blue" berry, or *Myrtillus uliginosa*, var. *microphylla*. In all, though, the berries are nowhere numerous, and Freuchen states that only once during all his stay in the North did the Eskimos gather more than they ate as they found them. A little farther south in Danish Greenland they are rather common and are preserved for winter use.

Apparently there are no poisonous mushrooms in Greenland, because the Eskimos do not hesitate to eat all species which they find. Likewise in times of stress they eat seaweed, both *Laminaria* and *Fucus*, boiling them down to a sort of jelly. The lichens, especially the big black *Gyrophora*, "tripe de roche," are also used in times of starvation, though the Eskimos state that continued use of these lichens causes disease.

Of late years the Smith Sound Eskimos have begun using *Pedicularis lanata* for a soup which tastes considerably like celery soup. The use of this plant has been introduced from Danish Greenland by the Eskimos who have come up from that region to live with the Smith Sound tribe.

But, Freuchen concludes, the fact remains that the Eskimos are satisfied only with a meat diet. Even after they have eaten at a white man's table a meal of cooked meat, vegetables, and fruit that would do justice to the heartiest white man's appetite, they resort at once after the meal to some raw walrus or seal meat, because, as they say, they are still hungry for some *real* food. W. ELMER EKBLAW

HUMAN GEOGRAPHY

Weather and Business. The Committee on Statistics of the Chamber of Commerce of the United States recently issued (1919) two bulletins, on business and weather in relation to rainfall and in relation to temperature. A paper on the general question of making practical use of such facts as are available was presented before the meeting of the American Meteorological Society at St. Louis, December 30, 1919, by Mr. A. W. Douglas of the Simmons Hardware Co. of St. Louis (*Monthly Weather Rev.*, Vol. 47, Dec., 1919, p. 867).

The two bulletins are based on the conclusion that spells of extreme heat and cold, of abundant rainfall and of deficient rainfall, tend to recur. Also, the same kinds of seasons have a tendency to recur, in the way of the association of dry years with dry years, and of wet years with wet years, for a comparatively brief period. Exceptions to this tendency occur, but in an experience of a number of years this general statement has proved to be fairly reliable for business purposes in from 75 to 80 per cent of the time.

A possible forecast of the general character of the weather, some months ahead, would obviously be of great advantage in relation to the probable sale of "seasonable goods," i.e. of "goods which sell only at certain seasons, and then because of the prevalence of certain kinds of weather." The author indicates that some degree of success has been attained by the application of the general principle of the probability of recurrence of certain types of seasons to the business in which he is interested. To quote: "Suppose a distributing house handling both lawn mowers and rubber hose wish to find out in August, 1918, about how they should order these goods for the coming season of 1919 compared with their sales in the season of 1918 just past. The theory I have spoken of forecast very definitely a wetter spring and summer in 1919 than in 1918 in the vicinity of St. Louis, and that is exactly what happened. Now, suppose this same house wished to know in February, 1919, what kind of an autumn and winter 1919–1920 would prove, as to temperature and snowfall, as compared with the similar season of 1918–1919, as affecting the sales of ice skates and snow shovels. The theory answers, a somewhat colder autumn and winter and rather more snow. Now, these incidents are the stories of actual happenings." R. DEC. WARD

GEOGRAPHICAL REVIEWS

THE DEVELOPMENT OF JAPAN

K. S. LATOURETTE. **The Development of Japan.** xi and 237 pp.; map, bibliogr., index. The Macmillan Co., New York, 1918. $1.50. 8 x 5½ inches.

This work is composed upon lines similar to those adopted in the author's "Development of China," to which indeed it well serves as a companion volume.

The author rightly makes the introduction of Buddhism into Japan the commencement of a new era, for with Buddhism, introduced from China by way of Korea, came Indian philosophy, Indo-Grecian art, and Chinese social and political theories.

Before taking up the discussion of the transformation of Japan by modern intercourse with Western nations, Professor Latourette pauses to describe somewhat at length the civilization of old Japan, in a very interesting and illuminating chapter. He says truly: "The Japan of 1917 is so decidedly the child of the Japan of 1850 that to know the first one must be acquainted with the second" (p. 80). A prominent feature of that civilization was the dominant position of the military class. "This class," he tells us "controlled the state" in the eighteenth century. Its presence "was in many respects to be a distinct advantage to Japan in the new age brought by contact with the West". . . . . "The government is still largely dominated by their descendants" (pp. 81, 82).

If we bear this in mind we shall better understand many things that have occurred in recent years in the Far East and better appreciate the present situation there.

Professor Latourette rightly calls attention to the debt which Japan owes to China. From China her early civilization was wholly derived. The influence of China he finds particularly evident in the family life and its solidarity. Feudalism grew up partly as a result of the failure of the attempt to adapt the administrative system of the Tang dynasty to Japanese conditions. Japan, of course, was not sufficiently advanced at that time to take over the political organization existing in China. Bushido he regards as unmistakably indigenous, although showing effects of Confucianism and Buddhism. The feudal lords no doubt had their retainers from of old, but Bushido, or "way of the soldier scholar," is undoubtedly modeled upon the chivalry of the Chinese feudal ages. It was China who divided her people into four classes; scholars, farmers, mechanics, and merchants. The shih, or "scholar," was placed first. Japan adopted this division, but as she placed her military class at the top of the social scale, she modified the word shih by the adjective bu, that is "military," making the foremost class that of the military scholar and the code of the military scholar the bushido. Many of the deeds of Japan's chivalrous knights can be paralleled in Chinese ancient history.

Bushido required the samurai to "sacrifice life, truth, and even his family if the service of his lord required it." This will explain some curious occurrences in recent years. The loyalty of the knight in the olden days was not to the Mikado but to his own daimio. Today we find sometimes as a result of this teaching of the loyalty of Bushido that men have attempted to justify themselves in the commission of crime by claiming that in so doing they were but showing their loyalty to their superiors. In 1917 a director of the Dai Nippon Sugar Company was found guilty of preparing false balance sheets and of bribing members of parliament. His defense was that the illegal acts were in accord with Bushido, that these measures were necessary to the success of the company. His loyalty, in other words, was to the company, not to the public. Professor Latourette states that Bushido encouraged the showing of magnanimity to a defeated enemy. But magnanimity to a defeated enemy does not appear to have been a marked characteristic of the Japanese knight. Captain Brinkley says: "By the standard of modern morality the Japanese samurai would be counted cruel. Holding that death was the natural sequel of defeat and the only certain way of avoiding disgrace, he did not seek quarter for himself or think of extending it to an enemy. Yet in his treatment of the latter he loved to display courtesy until the supreme moment when all considerations of mercy were laid aside." The wide gulf which divided the samurai from the commercial and agricultural classes made the military class indifferent to the sufferings of these lower orders and ofttimes brutal in their treatment of them. These things should be borne in mind by those who are disposed to think too highly of the system. If truth and honesty can be sacrificed through a mistaken sense of loyalty to one's superior and if mercy is wanting in the treatment of the less fortunate, it is not difficult to understand how men trained in such a school can be courageous and patriotic and yet be guilty of cruelty to men of another race, as is charged of the conduct of the Japanese in Manchuria and Shantung, and show such deception as was practiced towards the Western nations in regard to the Twenty-one Demands.

Issue must be taken with the statement (p. 151): "Like the Riu-Kiu Islands, Korea had in years past recognized the simultaneous suzerainty of both Japan and China. Tribute-bearing embassies were sent both to Peking and Yedo."

There does not appear to be any reliable evidence that Korea was ever tributary to Japan or ever acknowledged in any way her suzerainty until compelled to do so against the will of her ruler and people in 1895. It will always be a stain upon the good name of Japan that her accredited minister to Korea, Viscount Miura, was found guilty by a Japanese court of participation in the plot which led to the murder of the queen of Korea in October, 1895. For, although Viscount Miura was recalled, he was subsequently made a Privy Councilor and still holds that post.

That the war upon China over Korea was "a clever ruse of the government to withdraw the attention of the nation from the constitutional struggle" then going on in Japan seems a fair deduction from the condition of affairs at the time. The author, however, mentions this as the opinion of others, not his own.

The apology for the annexation of Korea (p. 183) seems to the reviewer unconvincing. If the self-determination of peoples is a right worth affirming, then the people of Korea would seem to have a right to such government as they desired, even though it might not have been so efficient as that which has been given them by Japan. That the Japanese government of Korea has, indeed, been very efficient cannot be denied, but one doubts whether that affords sufficient excuse for the violation of the repeated pledges given by Japan to respect her territorial integrity and independence. If there be anywhere in this world treaties that have been made "scraps of paper" those relating to Korea would appear to deserve a place at the head of the list.

The rapid increase of Japan's population explains the desire of the natives of that country to find a home in the fertile and sparsely settled valleys of Manchuria. But immigration ought not to bring in its train the interference of an alien government with the sovereign rights of a neighbor. Professor Latourette points out the discrimination shown by the Japanese in their management of the South Manchuria Railway against the trade of the citizens of other nations. The author, however, palliates Japan's violation of her word to preserve the open door, saying (p. 186): "Considering all the temptations that Manchuria presented and the cost at which a foothold in it had been acquired, it would have been strange, although highly commendable, had Japan stayed strictly by her plighted word."

Japan's relations with China during the World War are touched upon, but the book went to press before the latest phase of the Shantung problem developed. Of the Lansing-Ishii agreement he writes (p. 208): "It was greeted with no great enthusiasm by the press in either America or Japan, for to many of the public in both countries it seemed that each foreign office had conceded too much. The Chinese were bitter in their denunciation; the agreement seemed to them to be the desertion of their last remaining protector against the aggressions of Japan, and Peking registered a formal refusal to be bound by any conventions to which she was not a willing party."

On the whole the work is an excellent summary of Japanese history and is well adapted to serve as a university textbook. E. T. Williams

The Polish Population of Prussia Before the War

Eugeniusz Romer. **Polacy na kresach pomorskich i pojeziernych** [and French résumé under title:] **La population polonaise dans les pays limitrophes baltiques, maritimes et lacustres.** 255 pp.; maps, diagrs. (Series: Prace Geograficzne Wydawane Przez Eugeniusza Romera, Zeszyt II.) Lemberg, 1919. $11\frac{1}{2}$ x $8\frac{1}{2}$ inches.

Recent Prussian censuses for the four provinces Bromberg, Marienwerder, Danzig, and Allenstein are criticized in this work with regard to their representation of the Polish population. High credit is given the Prussian census bureau for scientific spirit, efficiency, and economy. They finish their total work in less than three years, at a cost of 2 pfennigs a head, *including printing!* But many inconsistencies are pointed out that seem due to the fact that the execution of the work in detail is in the hands of a great number of functionaries who are strongly biased against the publication of objective truth. Some specific complaints are that Germans are forbidden to give Low German as a mother tongue, while the Polish dialects, Kashubian and Masurian, must be reported as such and not as Polish; thus diminishing by 300,000 the number of Poles reported by the census. A further striking result is to make the isolated fragments of Slavic population in northern Allenstein, whose patriotism is sharpened by life among surrounding masses of Germans, insist on being reported as Polish, while the solid masses of Poles farther south from whom they came are declared to be Masurians! Moreover, since objective reality has not been reported, successive censuses report most freakish changes. For instance the Kreis Kartuzy, just west of Danzig, gave its percentages of Kasuhbian *and* Polish-speaking people at the four census dates 1890, 1900, 1905, and 1910 as 66.4, 69, 69.4, 72.1 per cent of the total population—very reasonable changes; but on dividing the number of Kashubians by the sum of Kashubians and Poles we find the percentage of Kashubians to be 43, 99, 47, and 99, incredible fluctuations. The people were not reporting their mother tongue, but a report of it was being put in their mouths by officials who did not contrive to be consistent.

Another inconsistency pointed out is the greater excess of women among the Poles than among the Germans. The suggestion is made that the Polish young men are sent to other parts of Prussia for their military service and German recruits sent to these provinces in their places. This is justified by census figures for the same districts by age periods. For 100 Polish men of 10–20 years there were 102 women, but for 100 men, age 20–30, there were 133 Polish women; for Germans the proportions of women for the two age periods are 100 and 95.

Many other discrepancies are noted.

The reviewer does not find all Dr. Romer's arguments clear, a condition to which very careless proof reading contributes. There is some haze around the school coefficient. Polish school children are reported by a separate census as numerous beyond expectation. It seems as if they were more consistently and objectively reported. A formula is based upon their number to estimate the true proportion of Poles in every district. Also use is made of numbers of voters for Polish candidates for the Reichstag to control the census figures.

The Prussian census estimates for the six eastern provinces of Prussia and five neighboring *Kreise* was 3,000,000 Poles. Romer would add of Kashubians, Masurians, and bilinguals nearly 500,000; for correction of official figures, over 500,000; and of Polish emigrants to other parts of Prussia, 900,000. So that he finds 4,000,000 to 5,000,000 Poles in Prussia in 1910.

He produces a map of the distribution of these Poles, which shows them occupying the ground much more continuously than on the maps of the Prussian census. This, too, he reproduces on the same scale and in the same style; also a map by Langhans of the same date and from the same data. He has had the areas of Polish predominance measured on all these maps, finding 11,000 square kilometers on the Langhans map, 17,000 on the map from the Prussian statistical atlas, and 20,000 on his own.

There can be no doubt the Germans underestimated the Polish inhabitants of these provinces. It is to be hoped we may have the detailed results of the plebiscite in Allenstein to compare with these figures. MARK JEFFERSON

A GEOGRAPHICAL COMPENDIUM ON NORTH AND SOUTH AMERICA

ONÉSIME RECLUS, edit. **Grande Géographié Bong Illustrée: Les Pays et les Peuples: Vol. 5 [North and South America; Polar Regions].** 371 pp.; maps, ills. H. DE LAMOTHE: **Canada,** pp. 3–40; J. G. KERGOMARD: **États-Unis,** pp. 43–136; L. MARC-SCHRADER AND J. G. KERGOMARD: **Les Antilles,** pp. 137–146; DÉSIRÉ CHARNAY: **Mexique et Amérique Centrale,** pp. 149–202; VICTOR HUOT: **Amérique du Sud (Brésil, Paraguay, Uruguay, République Argentine, Chili, Bolivie, Pérou, Ecuador, Colombie, Venezuela, Guyanes),** pp. 205–318; GUSTAVE REGELSPERGER: **Les Régions Polaires,** pp. 321–360; ANTOINE CABATON: **Les Modifications Territoriales de la Péninsule des Balkans,** pp. 361–364. Bong & Cie., Paris, 1914. 15 x 12 inches.

Volume 5 of this series of geographies (of which Vols. 1 and 2, Europe, were reviewed in the *Geogr. Rev.*, Vol. 6, 1918, p. 378; Vol. 3, Scandinavia and Asia, in the *Geogr. Rev.*, Vol. 7, 1919, pp. 194–195; and Vol. 4, Africa, in the *Geogr. Rev.*, Vol. 4, 1917, pp. 327–328) covers all the lands of the western hemisphere. Neither pains nor expense have been spared to make the book attractive; it is handsomely bound, printed on a fine grade of paper, copiously illustrated with many pages in color, well supplied with maps, and, most essential of all, it is a carefully considered and well-balanced account of the lands, peoples, and industries of the various countries of the Americas. The size of the book, printed in folio, and the excessive weight are, however, prejudicial to its use in a private library and will in all probability limit its use.

The maps deserve special commendation. There are double page maps, physical and political, of the larger divisions of the western world—a better physical map of the United States, 1:10,000,000, than can be found in most United States publications, and the collection of these, of which there are fourteen, would make an excellent general atlas for North and South America. In addition to these, the text has smaller maps, seventy-one in all, of climate, of density of population, and of special locations, such as the environs of New York City, which render the text particularly illuminating.

The 364 pages of text in the volume are divided among the divisions of the western hemisphere in the following proportions: Canada, 11 per cent; United States, 25;

Antilles, 2.5; Mexico and Central America, 16; South America, 32; Polar Regions, 13; and the Balkans—which discussion apparently is a supplement to an earlier volume with the materials brought up to the date of the settlement of the boundaries following the last Balkan War—0.5 per cent. The treatment of the countries with the exception of the United States is to a large degree similar and follows the usual order and topics found in most general geographies. In the case of the United States, the people particularly are made the object of an analysis, which shows a mixture of careful evaluation of the national character and a too great trust in national caricatures. While now and then the author describes certain specific or provincial traits as being more widely prevalent than they actually are, on the whole he has probably made as fair an estimate of the people of the United States as any one so situated could.

To see ourselves from the viewpoint of an outsider is at all times a desirable thing, although sometimes it is not altogether a pleasing experience; yet the reading of this description of the American character is not in the least unpleasant; on the contrary, possibly because of that self-assurance which the author insists is one of our leading traits, it is often amusing.

The account opens under the heading of "a country without a name," and it is stated that the "United States of America" is not a sufficiently explicit designation for the Union, and furthermore is an awkward name in that it does not allow the use of a single word for the inhabitants as is common in Europe when one speaks of the French, English, etc. Again, in the same connection, it is hinted that the insistence upon the word "American" shows a desire to absorb all of the two continents and to extend the "America for the Americans" slogan much more than to a belief in the Monroe Doctrine of exclusion of eastern hemisphere control; to extend it even to an actual absorption of the western world by the United States. This same feeling is expressed again in the analysis of the race by the insistence that American imperialism has not said its last word. While Africa seems closed to it, the breaking up of China and the troubles in Latin America, it is predicted, will give occasion for its manifestation again as formerly at Panama.

The author considers the unity of races in the United States through absorption as a wonderful phenomenon. He quotes the motto "E pluribus unum" as more than a motto, as the statement of a reality which has come to pass through the experience of years. That many races, of many creeds, from all kinds of lands should settle in a strange land and become absorbed by another race altogether foreign to it is to the European a strange and remarkable realization of the ideas which the political union of a few somewhat allied colonies in the infancy of the Republic somewhat ideally expressed in this motto.

Our "mushroom" cities—and all save Boston, to which the author pays homage like a Bostonian, and New Orleans are rated in this class—are too new to attract the European, whose idea of a city includes a historical background with relics, sepulchers, and sacred shrines. The absence of a history is given as a reason for the common designation of the streets by numerals and letters, as "corner of 7th Avenue and 253rd Street," on the ground possibly that since the country is so new we have long ago used up all the historical and descriptive names and thus must resort to numbers as designatory titles. The idea that such a system is one of great convenience to the stranger has apparently never been introduced to the author or, if so, has never been accepted as worthy. "If you know one American city, you know them all." The streets cross at right angles, there are "blocks" of equal dimensions, and in the business districts there are invariably "sky scrapers" because the land is so valuable—these are the main items in the description.

The American is described as above everything else devoted to business. Trading has assumed in Yankeeland an importance beyond its due, the author asserts; it occupies the whole life, the child at school does not dream of the stripes of the officer or of a great administrative station, his dream is to be a great business man. Save the small minority who continue their studies, children are thrust into active life at an age when the little European thinks only of play. It is amazing that an estimate of the American tendencies is given so confidently by a scholar who has so much to say about the historical background, without some slight glimpse into the idealism and ethical doctrines which are instilled into the American youth at school through the medium of literature. If this had been done, and the models which are set for the youth to emulate—from Robert Bruce up—had been appreciated, the author would not have emphasized the fact that the man who fails is not dishonored and lost, as in France, but is allowed to begin again. The greater part of this estimate is one of superficial comparison without any attempt to dig down to the roots.

In concluding, the American is described as muscular and lean, boastful of his strength and endurance, enjoying out-of-door sports, and somewhat less well-knit than the Englishman. "The women are pretty, at times remarkably handsome, especially in high society. Those living in Baltimore are universally famed, tall and slender, gracious, decidedly alluring, owing to sports and to the independent life led since infancy. The eyes and the hair are superb, the color recalling that of the English; but, unfortunately, the teeth are often large and very frequently filled with gold." The American diseases are enumerated as tuberculosis; stomach trouble, induced by the use of ice water, spiced foods, sometimes by alcoholic liquors, the habit of midday meals, swift living, and constant attention to work; nervousness due to a noisy and exciting work; and appendicitis.

These are given as types of estimates of the American. It is not desirable to judge the entire work by these, for in the descriptive parts of the text, and it is mostly that, the writers are not influenced so much by their own ideals of life and appear more at home in interpreting topography and climate than they do in dissertating on character.

Robert M. Brown

Travels in Alaska

Hudson Stuck. **Voyages on the Yukon and Its Tributaries: A Narrative of Summer Travel in the Interior of Alaska.** xvi and 397 pp.; maps, ills., index. Charles Scribner's Sons, New York, 1917. $4.50. 9 x 6 inches.

Dr. Stuck is a Protestant Episcopal clergyman who has lived many years in Alaska. All he has written about that country is worth-while because he is a keen observer who has traveled thousands of miles there, has studied the things he describes, and strives for accuracy in all he writes. He expresses regret that he lacks scientific geographical training; but he has qualities that make his books valuable to all readers who seek reliable accounts of Alaska. He is a keen observer, mixes common sense with all he writes, seeks nothing but the truth, and records what he sees in a way to hold attention and interest.

Dr. Stuck traveled in his steam launch *Pelican* along the Yukon River and its tributaries for ten summers, covering in that time about 30,000 miles and noting all the way the things that seemed to him most important, such as the regimen of the waterways, the forests, plains, flora, fauna, climatic conditions, mines and miners, settlements, natives, and so on. We may consider this book as a fairly complete summary of Alaska, in most of its aspects.

Only a few bits of the information the book contains can be mentioned here. Dawson, the capital of the Yukon Territory, is in process of steady decay because the placer diggings are exhausted and no quartz veins have yet been discovered to prolong its life. The town had extensive development; it contained many substantial buildings and attractive residences and gardens, but it will meet the fate that befalls most placer-mining towns after their alluvial gold is exhausted. Forty Mile, Circle City, and other famous placer regions are also nearly exhausted.

Above its White River affluent the Yukon is a clear, pellucid stream; White River heads in glacial brooks, and its turbid waters so becloud the Yukon as completely to destroy its limpidity. At the mouth of the Tanana tributary, darkened with the wastage that the glaciers at its source have dug from the soil, the Yukon turns nearly black. What Dr. Stuck saw, in the course of years, of the tremendous power of ice to grind down mountains and carve out valleys, convinced him that glaciers have been far more potent than earthquakes and volcanoes and most other agencies in changing the surface of the earth.

It is only of late years that the name Yukon River has been applied to all its variously named stretches. It was discovered piecemeal, and explorers gave special names to the parts they reached, not knowing that they constituted a continuous stream.

Years ago, our newspapers had much to say of the agricultural possibilities of Alaska. Dr. Stuck does not share these sanguine views. It has been proved, he admits, that hardy and early varieties of grain and garden vegetables may be ripened. But truck farming is profitable only in the neighborhood of the mines. When mining shall give out remote Alaska can never hope to raise crops for export in competition with other countries.

Cyrus C. Adams

Latin American History

W. W. Sweet. **A History of Latin America.** 283 pp.; maps, diagrs., ills., bibliogr., index. The Abingdon Press, New York and Cincinnati. 1919. $3.00. 8½ x 6 inches.

Teachers of Latin American history have often sought, unsuccessfully, for just such a book as this. There has been no comprehensive work in English, we believe, that would serve as a textbook for the courses now being given in many of our colleges and universities. This is true particularly regarding the colonial period. Over a half of the present volume is given to that field. In its wealth of detail it will also be of value as a reference work to the student and to the general reader. For the latter purpose the volume would be of far greater service if the reading lists contained reference to other than English works.

As to the maps—there are twenty of them in all—some are well suited to the end desired, though only sketch maps. Others, such as that showing the mineral production in South America (opp. p. 244) are worse than useless. Tin is shown as a product of northeastern Bolivia, the low rubber country of the Amazon. No petroleum is ascribed either to Peru or Argentina, nor is coal given among the minerals of Chile. The railway map opposite page 244 would lead one to suppose that there was no possibility of going by rail from Buenos Aires to either Asunción or Rio de Janeiro, while the line shown as skirting the western shore of Lake Titicaca exists only as one of the numerous *proyectos* that cover the continent.

Errors in statements, too, occur. Tacna and Arica were not lost by Bolivia but by Peru (see p. 187). The sovereignty of the vast Loreto region on the headwaters of the Amazon still remains undecided (see p. 185).

In spite of such faults this work should be of real and permanent value to students of Latin America.

A Topographical Survey of the Aconcagua Region of the Andes

Robert Helbling. **Beiträge zur topographischen Erschliessung der Cordilleras de los Andes zwischen Aconcagua und Tupungato.** 77 pp.; maps, ills. *Jahresbericht Akad. Alpenclub Zürich,* Vol. 23, 1918.

Dr. Robert Helbling of Flums, Switzerland, the author of this exceptionally valuable cartographic study, intended to prepare a large volume on the mountain journeys that he made in the Argentine-Chilean Andes, chiefly in company with Dr. F. Reichert, between 1906 and 1912, concerning which Reichert has already published several articles; but, the war intervening, the present fraction of the total is published with the expectation of bringing out the remainder later. Both text and maps are manifestly the work of a well-trained and experienced topographer and mountaineer, such as Switzerland may well take pride in producing.

The first section of the essay (pp. 5–8) gives a geographical summary of a 70-mile stretch of the Andes between Aconcagua, 7,010 meters, in latitude 32½° S. and Tupungato, 6,650 meters, in latitude 33½° S. Near the former mountain is the Uspallata Pass, 3,799 meters, crossed by Charles Darwin and by Jeffries Wyman, 85 and 60 years ago respectively, and now tunneled by the Transandine Railway. The second section (pp. 9–22) treats the previous mapping of the district and corrects certain statements to the effect that only small cirque-glaciers exist in this part of the range by the announcement that large and long valley-glaciers of true Alpine type occur. A third section (pp. 23–27) describes the author's topographic surveys, made by the "stereophotogrammetric" method, at the cost of the Transandine Railway and of the South American Hotels Company, supplemented by personal funds. The resulting maps, as far as published, are described below. Notes on the geology, physiography, and glaciation occupy a fourth section (pp. 28–46): Tupungato is here described as a lofty volcano, its summit seeming to be a broken or dissected crater rim, while several lava flows descend its flanks. Aconcagua, although long reputed to be a volcano, is surely not so, as several earlier explorers have pointed out; it is the eroded remainder of an overthrust mass, chiefly composed of hornblende porphyry. About midway between these two lofty summits is a group of mountains dominated by the Juncal, 6,110 meters, also not a volcano, although consisting largely of volcanic rocks which have been uplifted and dissected into their present form. Here are the largest glaciers of the area under consideration; the longest of them, the Ventisquero del Plomo, is the trunk of a complex glacial system; it is illustrated by several half-tone views in the text and measures 17 kilometers from its snow crests at 5,000 meters to its end at 3,165 meters.

In general the mountainous highlands show maturely dissected or subdued forms ("Die Formen . . . . entsprechen einem reif zerschnittenen, z. T. sogar unterjochten Bergland"), in which, after upheaval had introduced a new cycle of erosion, deep and mature trough valleys have been eroded, heading in glacial cirques; but the rounded forms of the lofty highlands, true "Mittelgebirgsformen" in spite of their height and of interruptions here and there by unsubdued cliffs, still prevail between the deep valleys; and the cirques, large as they are, appear only as niches excavated in the mature domes of the earlier cycle. Lateral valleys are said to hang above the main valleys, but the author does not take sides for or against glacial erosion as a cause of their hanging, although he mentions the former greater expansion of the glaciers as indicated by the occurrence of glacial striae at an altitude of about 3,000 meters, 20 kilometers down valley from the present end of the Plomo glacier. The dry climate supports few streams, and the heavy mountain masses are therefore little subdivided between the main valleys. Rapid weathering of relatively weak rocks has cloaked the mountain sides with long slopes of detritus. The main valleys show neither rock steps causing rapids or falls, nor rock basins holding lakes, but are heavily aggraded with rock waste swept down by their braided streams and therefore present an equalized descent. Vegetation is scanty and animal life is rare; except near the railway, no sign of human occupation are to be seen. Thus the Andes here contrast strongly with the Alps. They lack the enlivening alternation of bold peaks, bare cliffs, and brilliant snow fields, of forest, pasture, and field; the surface is largely stony and sterile, without splashing streams and whitened cascades. No human settlement or trace of human activity is visible, although wretched, forsaken herds are occasionally met. The unconcealed natural colors of the bare rocks unite in manifold and quite improbable combinations, which with the simple outlines of huge mountains, their untouched isolation, and complete silence, constitute views of magnificent and restful beauty.

A sixth section (pp. 46–77) is devoted to Alpinism, for which the region is highly recommended. A list of all important ascents since 1882 is here compiled. It may be noted that a good hotel is now established at the Puente del Inca, 2,850 meters, 25 kilometers east of the Uspallata tunnel, where camping equipment, mules, and guides can be hired. An 18-page supplement on the height of Aconcagua is bound in with the reprint of the main article. This great mountain is given an altitude of 7,010 ± 32 meters and thus ranks as the highest of all American summits.

The five maps that accompany the essay are the product of the map-engraving establishment "Kartographia Winterthur." One is a general map compiled from various sources on a scale of 1:250,000, extending somewhat north and south of the stretch of the range that Helbling especially studied. The four other maps are large sheets reproduced on a scale of 1:25,000 from originals of the same scale by the author; three of them represent a district measuring about 30 by 15 kilometers around the Juncal with its many large glaciers, presumably the center of touristic interest; while the fifth map represents the southwestern side of Tupungato, with its glaciers, and shows the author's path of ascent to the summit. These maps are of exceptional interest, being much more detailed than any previously published. The mountains are tinted in brown, with sketched brown contour lines of 25 meters interval on the smoother slopes, and brown hachures for the more abrupt forms. Snow and ice are contoured in blue, with a light-blue tint on their steeper parts, and with appropriate indication of crevasses and moraines. As the mountains and glaciers are rarely named, Helbling added several new names to the few that he found in local use to aid his descriptions; all are given in Spanish. Maps and text alike should prove indispensable to future explorers of the seldom visited Juncal group. W. M. Davis

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The Society is not responsible for the opinions or the statements of writers in the Review

Published monthly by the American Geographical Society
Broadway at 156th Street, New York, N. Y.

Price, fifty cents a number Five dollars a year

Entered as second-class matter, January 22, 1916, at the Post Office at New York, N. Y., under the Act of August 24, 1912
Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 30, 1918

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Vilhjalmur Stefansson is known for his repeated journeys in the Arctic and especially for his work as leader of the Canadian Arctic Expedition, 1913–1918. He has contributed several articles to the *Review* and is the author of an admirable book entitled "My Life with the Eskimo," 1913. His field work is characterized by an intimate knowledge of native living conditions and of the technique of Arctic travel.

Mr. Ward is professor of climatology at Harvard University and one of the foremost authorities on climate in this country. This and other of his recent contributions to the *Review* form part of a book on the climatology of the United States in the course of preparation.

Mr. McMahon, who writes from Australia, points out that the quantity of pearl and trochas-shell now being sent to America from the Torres Straits gives an additional interest to the little known islands described in his paper.

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THE PROBLEM OF SANTO DOMINGO

By Fred Rogers Fairchild

Yale University

An interesting experiment in American statesmanship was inaugurated by the action of the United States when, in April, 1916, American marines landed at old San Geronimo castle, near Santo Domingo City, and the first step was taken in the American occupation of the Dominican Republic. Threatened civil war was thus averted, and, after some armed resistance had been overcome and political obstacles had been finally removed, a proclamation was issued on November 29, by Captain (now Rear Admiral) H. S. Knapp, commander of the American naval forces in Dominican waters, declaring the republic under the military administration of the United States.

The problems resulting from this action are many, and one seeks in vain for any clear statement to guide our policy in the administration of the affairs of a weaker nation, whose irresponsible political career has more than once forced her upon the attention of the United States. The attempt to secure the development of rich natural resources without exploitation, to protect ourselves against disorders without denying the right of our neighbors to self-government, is fraught with difficulties. Yet in the adequate solution of these problems must lie the justification for the presence of the military power of the United States in the Dominican Republic.

HISTORICAL SKETCH

In many ways Santo Domingo makes a strong appeal to our interest. Historically, her connection with the adventures of Columbus and the first white settlement in the Western hemisphere endows her with a glamour of romance, which has been deepened by her four hundred years of turbulent history. Her geographical situation on the great trade route between the

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Old World and the New, her economic resources, and the character of her people furnish the elements of a particularly significant study for the thoughtful American, in view of the recent developments in the relations between our Government and the smaller republic.

The doleful tale of Santo Domingo's long-continued attempt at self-government, with its bewildering succession of presidents and its lurid record of revolution and bloodshed, is matter of history.[1] Irresponsible finance and flagrant disregard of her international obligations finally brought the republic into conflict with certain European powers. Under the threat of invasion, the Dominican Government appealed to the United States for help. An arrangement was accordingly made, in 1905, under which the United States Government assumed the management of the Dominican public debt and the control of her customs administration. The debt was funded, the foreign creditors appeased, and the customs honestly and efficiently managed.

For some time things went fairly well, and considerable improvement in the country's economic condition followed. But the old habits were not to be so easily thrown off. Once more bandits arose and revolutions broke out in the good old way. A new national debt grew up, in violation of the agreement with the United States. This breach of faith and the increasing disorders finally led to the American occupation in 1916. Since then the Military Government has administered the legislative and executive departments of the national government. The judicial branch and the main control of local government have been left in the hands of the Dominicans.

In the winter of 1917–1918 the writer served as financial adviser to the Military Government, and it is upon observations made at that time, supplemented by later information from the Military Government, that this article is mainly based.

An Island of Vast and Varied Resources

The island of Santo Domingo, or Haiti, lies midway between Cuba and Porto Rico in the long chain of the West Indies. It is divided between the republics of Haiti and Santo Domingo, the latter occupying the eastern two-thirds of the island and having an area of about 18,000 square miles, about the combined area of New Hampshire and Vermont. It is five times the size of Porto Rico. Its greatest length is 260 miles and its greatest breadth 170. Its coast line, quite irregular and indented with large bays and good harbors, is more than 1,000 miles in length. Puerto Plata, the principal northern city, is some 1,250 miles from New York and 700 miles from Havana, Cuba.

A central mountain range, the Cordillera de Cibao, divides the country into two great regions. On the north is a wonderfully fertile valley, some

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[1] See in particular Otto Schoenrich: Santo Domingo; A Country With a Future, The Macmillan Co., New York, 1918.

150 miles in length and from 10 to 15 miles wide, which, with the rich slopes to the north, is known as the Cibao. On the other side of the mountain range is the great southeastern plain, extending from the Jaina River west of Santo Domingo City to the eastern extremity of the island, 175 miles long and about 30 miles wide. This area, known as the Seibo Plain, also has fertile soil and favorable climate. A considerable area in the western part of the country is arid and unsuited to agriculture except with irrigation. The central portion of the republic is mountainous, containing some features that are distinctly imposing. Loma Tina rises to an altitude of over 10,000 feet and is the highest peak in the West Indies. There are several large rivers, generally torrential and often losing much of their water through seepage into the soil before reaching the sea. The only lakes of any size are Lake Enriquillo and Lake Azuey in the western part near the Haitian border. Though scarcely five miles apart Enriquillo is 102 feet below, and Azuey 56 feet above, sea level. Both are salt lakes and are said to have no outlets.

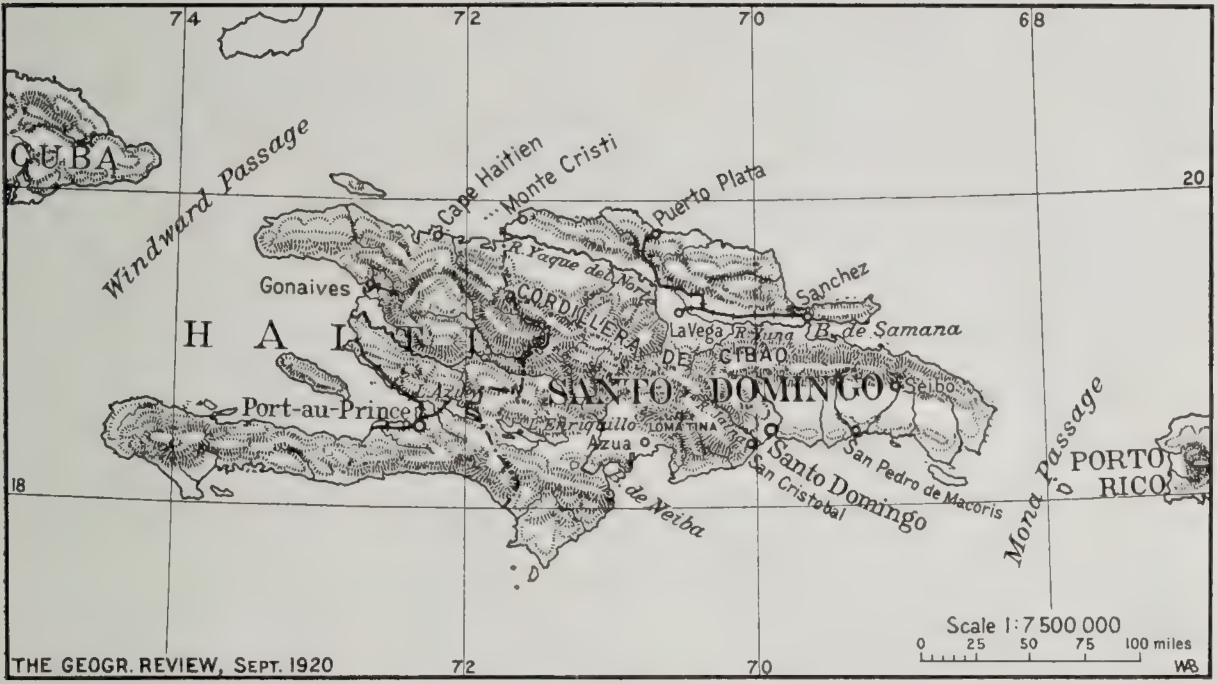

FIG. 1—Sketch map of Santo Domingo.

Santo Domingo has a delightful climate, a soil of great fertility, and a remarkable abundance and variety of natural resources; yet four hundred years of white settlement have scarcely witnessed the beginning of material development. Economically she is still a primitive community.

LEADING PRODUCTS

The leading products of the country are agricultural, the most important being sugar, cacao, tobacco, coffee, skins and hides, bananas and some other fruits, honey and wax, cotton and other vegetable fibers, coconuts, etc. There is almost nothing in the way of general farming or truck gardening beyond the small garden patch that supplies the family table. Many agricultural products that could apparently be raised in the country are imported. For example, rice is one of the chief articles of diet of the people and is practically all imported. Considerable areas are suited to grazing, but there has been little development along this line. The cattle are of inferior breed, and the native meat can scarcely be considered a delicacy. Milk and butter are almost unknown.

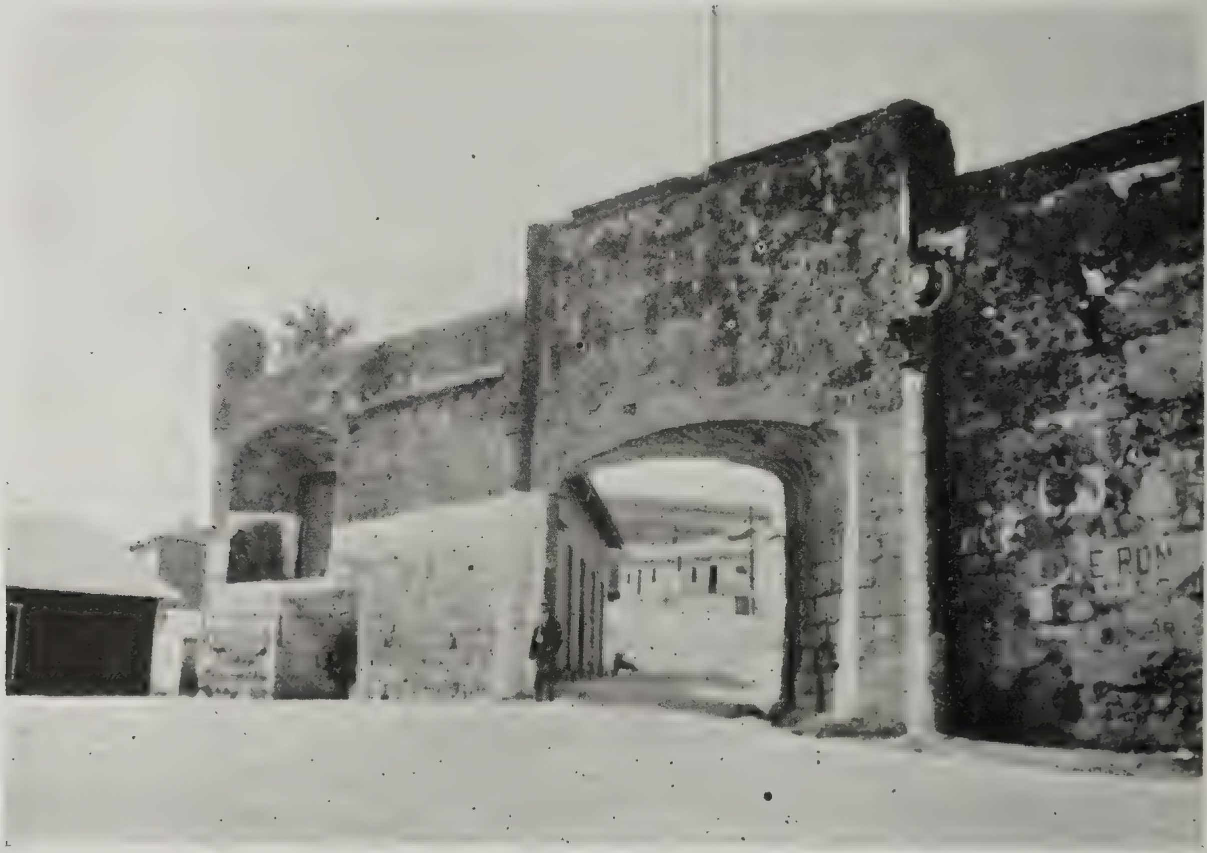

FIG. 2—The gate of San Diego, Santo Domingo City. This, called also the Gate of the Admiral, is one of the three original gates of the city. It is near the ruins of the house of Diego Columbus and affords communication, through the old city wall, from the wharves to the city.

The country is rich in timber of various kinds, including mahogany, lignum vitæ, and other valuable woods. A small amount is obtained for local use, and a little is exported. Near the chief seaports the supply of marketable timber is pretty well exhausted, while the enormous forest resources of the interior are virtually untouched. There is no extensive logging or lumbering industry at present, the chief obstacle being lack of transportation facilities.

Little is known of the nature or extent of the country's mineral resources. From time immemorial the natives have washed gold from the river sands, and these deposits appear to be widespread. There is some mining of copper. Oil has been found but not successfully marketed. Various other minerals are said to be abundant. It is possible that considerable mineral wealth awaits future discovery and development.

The waters surrounding the island abound in fish, but no important fisheries are developed.

With the single exception of the sugar mills, there is no very important manufacturing industry. A few distilleries and some small factories for the making of soap, cigars, cigarettes, candles, etc., are almost all there is beyond the stage of simple domestic handicrafts; and even here there is only slight development.

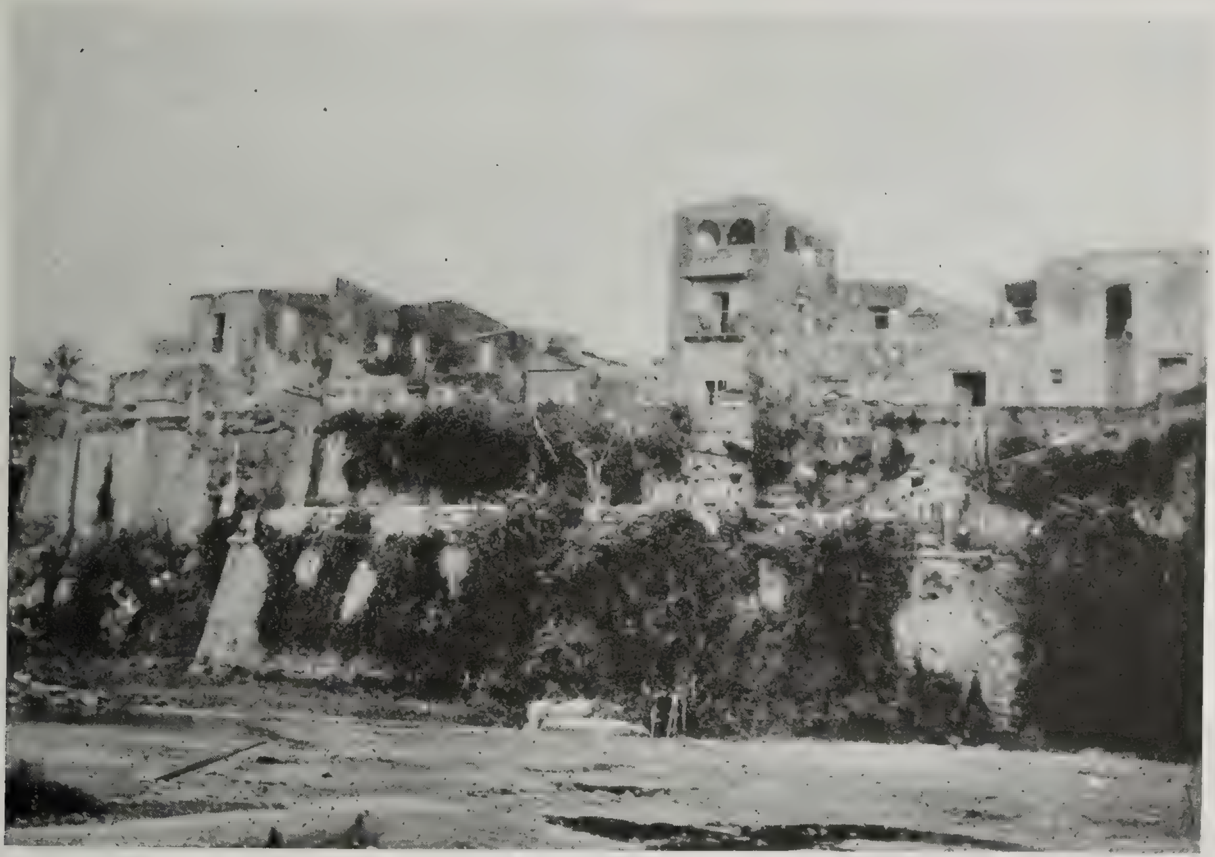

FIG. 3—Old houses and fortifications, Santo Domingo City. The city, founded by Bartholomew Columbus in 1496, is the oldest white settlement in the New World. (Photograph by the late Theodoor de Booy.)

THE SUGAR INDUSTRY

The one up-to-date enterprise is the sugar industry. The soil of Santo Domingo is remarkably suited to the growing of sugar cane, and the climate is favorable. So rich is the soil that cane will grow from the same roots for ten or even twenty years, whereas in Porto Rico replanting is generally necessary every three years. Sugar plantations have developed rapidly in recent years. Much foreign capital, principally American and Italian, is invested in the sugar estates and in the grinding mills, plantation railroads, irrigation systems, and other equipment. These establishments are great business enterprises, thoroughly up-to-date in plant and organization. Besides the cane raised on the estates a very considerable product is grown on small plantations by native *colonos*, who sell it under contract to the mills. The sugar estates and mills give employment to many Dominican laborers; but the supply of native labor is not sufficient to harvest the crop, and the companies bring in laborers from the neighboring islands, returning them at the end of the season. The sugar is ground on the island or in the neighboring mills of Porto Rico, but there is no refining of sugar in Santo Domingo. San Pedro de Macoris, in the vicinity of which most of the large plantations are situated, is the chief sugar-exporting port.

Transportation

Means of transportation are in a very backward state. There are two railroads, with a combined length of barely 150 miles. They connect the two chief ports of the northern half of the island, Puerto Plata and Sanchez, with the rich interior. The sugar estates have their own private railway systems, mostly narrow gage. There are about 125 miles of such railways. Electric railways do not exist. A few years ago good roads were practically unknown. Since the American occupation some progress has been made in the construction of first-class roads, of which about 180 miles have been completed. Except for these few modern highways, the people depend on the most primitive country roads and trails. Transportation on land is generally by pack animals and rude carts, with a few motor-bus lines operating between cities connected by roads. Large parts of the country are practically inaccessible, especially in the rainy season.

Most of the important towns are on the seacoast, and transportation between them is by boat, with poor and irregular service. Needless to say, internal commerce is only slightly developed, though inadequate transportation is not the only cause.

Foreign Commerce

Foreign commerce, on the other hand, is of great importance. Since the Dominicans devote themselves so completely to agriculture and the simplest industries, they are compelled to rely upon foreign trade for almost everything they need in the way of manufactured goods. The figures of exports and imports make a very respectable showing for a country of the size and character of Santo Domingo, and the absolute dependence of the people upon imported goods makes the foreign trade even more important than the mere figures would indicate. The accompanying table (Table I) shows the value of imports and exports during recent years.

The table testifies to the large growth of the country's foreign trade since the Customs Receivership began compiling the statistics. It should be remembered, however, that a considerable part of this increase is only nominal, being the result of rising prices. It is evident that Santo Domingo has a large excess of exports—what is popularly called a "favorable balance of trade." Part of this balance represents payment of interest and amortization upon the national debt, practically all of which is held abroad. This calls for a heavy tribute averaging about $2,000,000 a year. Another factor in the trade balance is the large investment of foreign capital in the country's industries, particularly the sugar estates. Interest and profits paid to foreign investors account for millions of dollars of exports. Like every debtor nation, Santo Domingo must thus pay with her products an annual charge to her foreign creditors. Only the excess above this charge gives her the power to command imports of foreign goods.

TABLE I—FOREIGN COMMERCE

	EXPORTS	IMPORTS
1905	$6,986,098	$2,736,828
1906	6,536,378	4,065,437
1907	7,628,356	4,948,961
1908	9,396,487	4,767,775
1909	8,113,690	4,425,913
1910	10,849,623	6,257,691
1911	10,995,546	6,949,662
1912	12,385,248	8,217,898
1913	10,469,947	9,272,278
1914	10,588,787	6,729,007
1915	15,209,061	9,118,514
1916	21,527,873	11,664,430
1917	22,444,580	17,581,814
1918	22,376,574	20,168,952

The principal articles of export are the products of the country's extractive industries already named. Table II shows the values of the most important articles exported in the year 1918.

TABLE II—VALUE OF CHIEF EXPORTS, 1918

Sugar (raw)	$11,991,399
Sugar cane	513,402
Molasses (of sugar)	142,356
Cacao	3,917,012
Tobacco leaf	3,623,780
Coffee	536,573
Honey	584,779
Beeswax	163,137
Goat skins and cattle hides	169,156

The imports into the country represent a great variety of necessities, most of them, though not all, being manufactured articles. The sixteen principal groups, with their values in 1918, as analyzed by the Customs Receivership, are given in Table III.

Table III—Value of Chief Imports, 1918

Cotton and manufactures of cotton	$3,643,806
Vegetable fibers, and manufactures of	1,088,426
Rice	2,543,320
Wheat flour	512,786
Foodstuffs (except rice and wheat flour)	1,375,458
Hides and skins, and manufactures of	782,562
Mineral oils	619,274
Woods, and manufactures of	475,710
Iron and steel, and manufactures of	1,501,531
Machinery and apparatus	1,888,292
Agricultural machinery, tools, and implements	238,045
Automobiles	199,265
Other cars, carriages and vehicles, and parts	427,832
Chemicals, drugs, oils, fats, etc.	352,468
Liquors and beverages	345,416
Cement	227,065

Business and Social Conditions

Business organization in Santo Domingo is generally very primitive. With a few notable exceptions there is no development of "big business." Few enterprises are incorporated. There are three banks. Two of them are branches of the International Banking Corporation of New York and of the Royal Bank of Canada respectively. They are important institutions and do a considerable business, mainly in the cities. The Banque Nacional is a local institution of less importance. The country districts are very poorly supplied with banking facilities. The sugar mills and estates are the largest and most highly organized enterprises. They belong to corporations of foreign investors. The single large banana plantation belongs to a foreign corporation. The rest of the country's agricultural industry is in the hands of individuals and small companies. Copper mining is being carried on in a small way by a corporation with foreign capital. There are no large interests engaged in cattle raising or logging. One of the railroads belongs to the Dominican Government; the other is the property of a corporation of English and Scotch capitalists. There are no other large corporations engaged in the transportation business except the steamship companies. Water transportation with the outside world is in the hands of foreign steamship companies; there are just two locally owned steamboats, each the property of a Dominican corporation. Communication by telephone, telegraph, and wireless is in the hands of the Government. The French Cable Company owns the submarine cable and a few land telegraph wires.

There is little accumulation of wealth among the people. A very few persons might be called moderately wealthy; only a small number could be classed as even well-to-do. The great mass of the population is distinctly

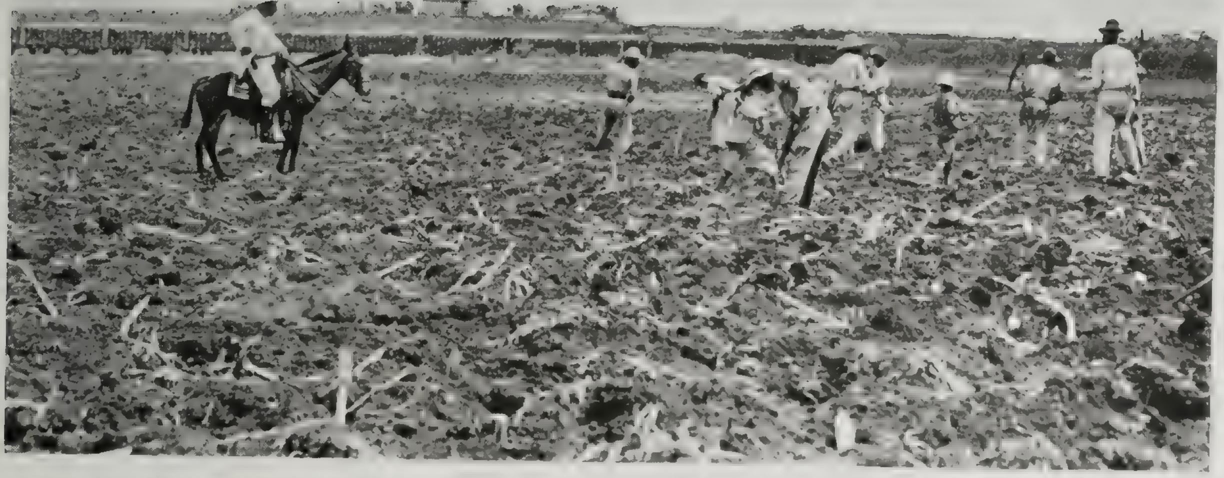

FIG. 4

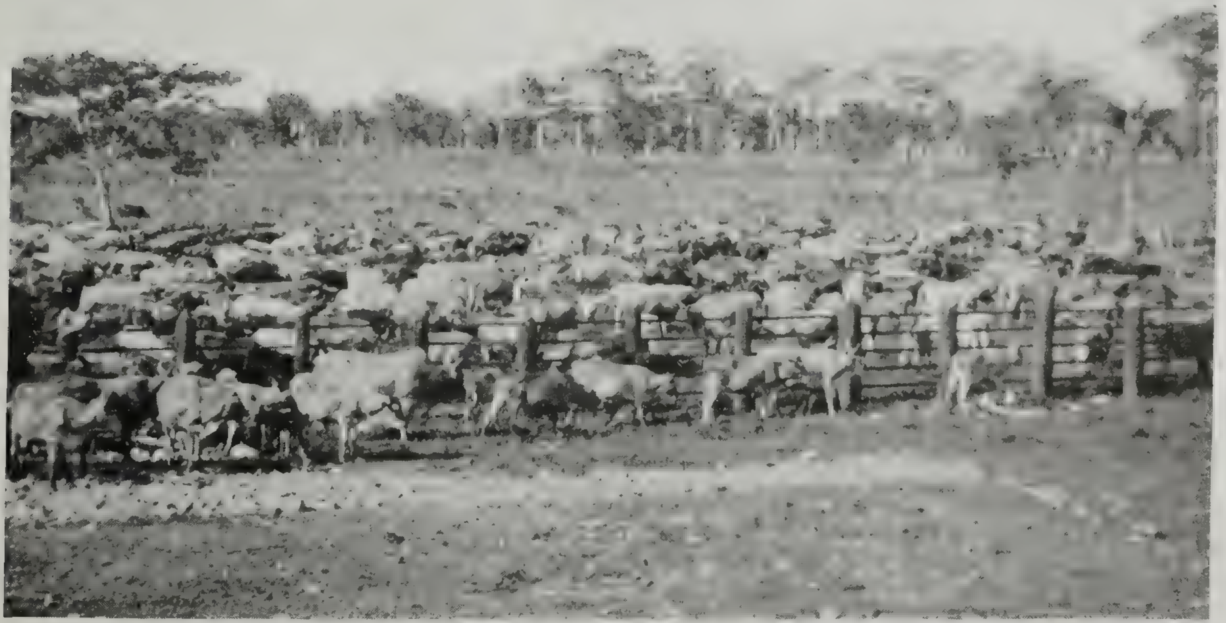

FIG. 5

FIG. 4—Preparing an old sugar cane field for replanting. The soil of the Dominican cane lands is so rich that replanting is only necessary every ten years or more. (Photograph by the courtesy of Bartram Bros., New York.)

FIG. 5—Raising bulls for cane hauling. (Photograph by the courtesy of Bartram Bros., New York.)

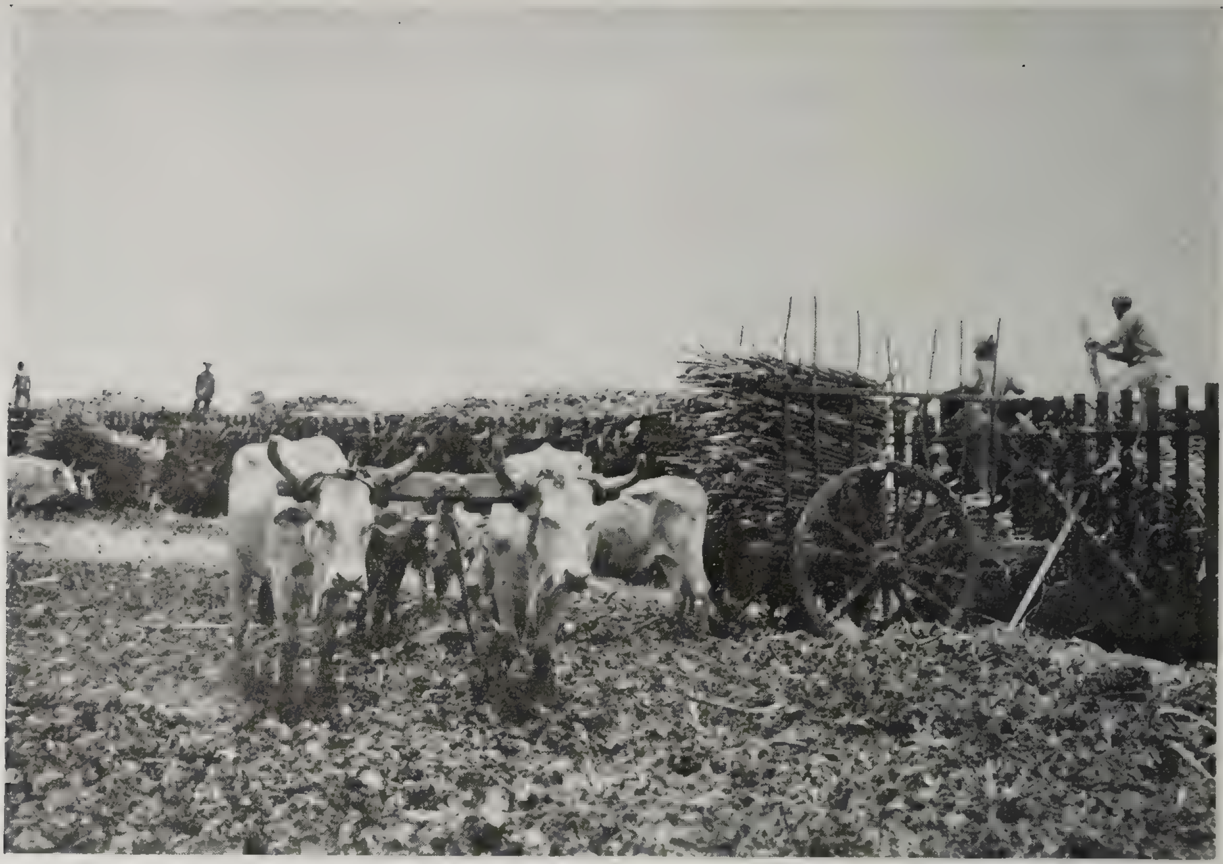

Fig. 6

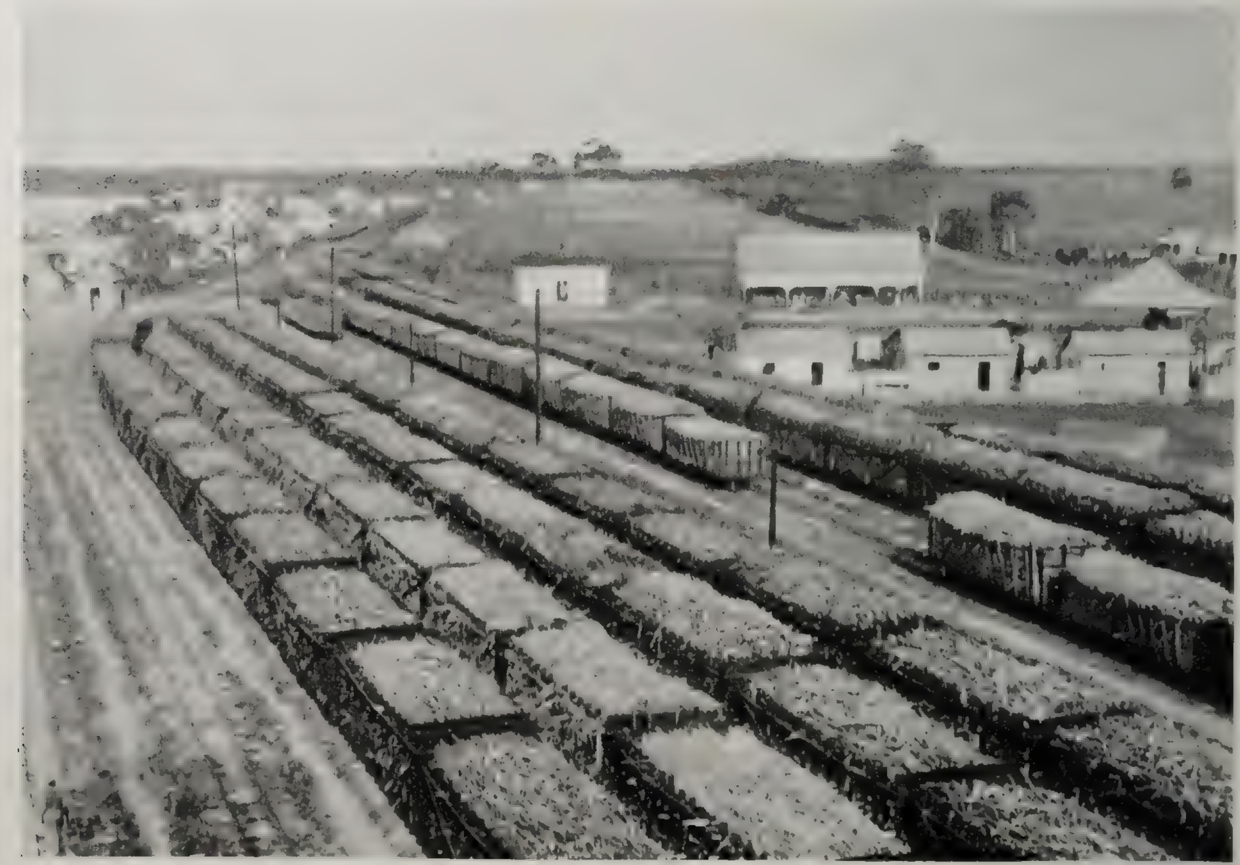

Fig. 7

Fig. 6—Cane transportation from the field to the railroad by bullock carts. (Photograph by the courtesy of Bartram Bros., New York.)

Fig. 7—Sugar cane in cars waiting to be milled or ground. (Photograph by the courtesy of Bartram Bros., New York.)

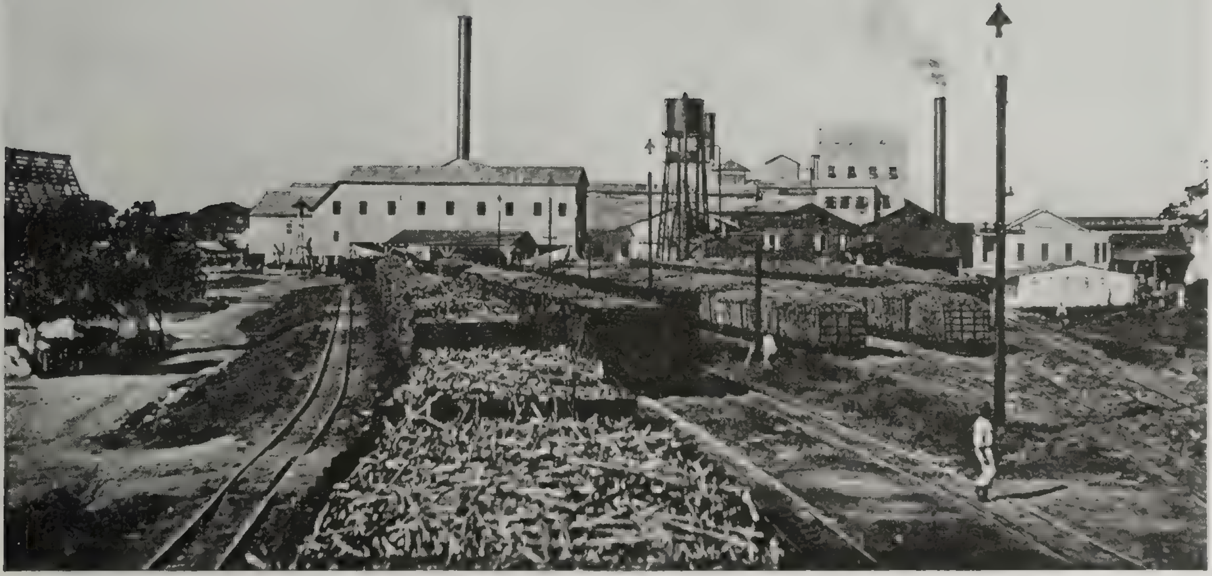

FIG. 8

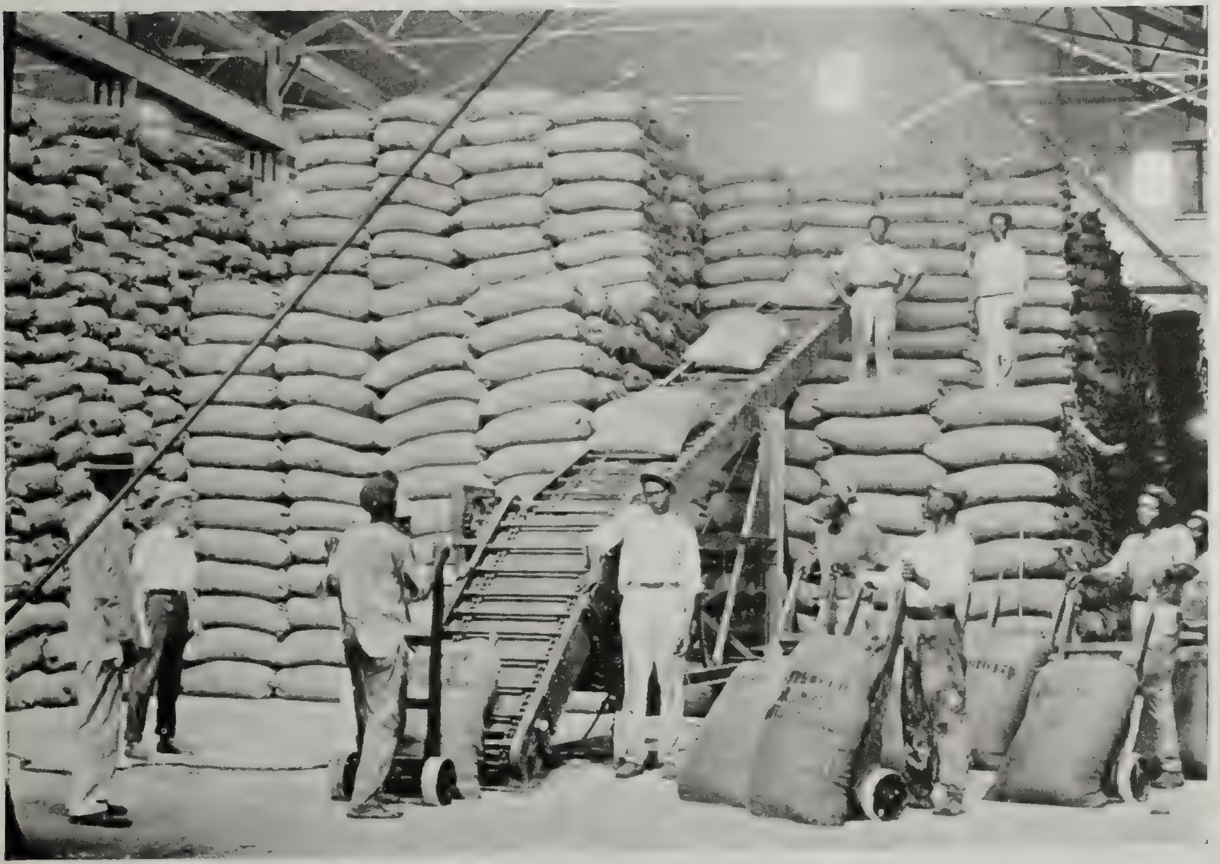

FIG. 9

FIG. 8—Sugar factory of the American-owned Consuelo estate in the neighborhood of San Pedro de Macoris. This factory has an annual production of 35,000 tons of raw sugar. (Photograph by the courtesy of Bartram Bros., New York.)

FIG. 9—Raw sugar in the warehouse awaiting shipment. (Photograph by the courtesy of Bartram Bros., New York.)

poor, with only the bare necessities for life on a low standard of living. However, the climate and the bounty of nature make it an easy matter to maintain this standard.

The educational system is very primitive. There are no important private educational institutions, the church does almost nothing in this field, and the little that is done by the Government is wholly inadequate.

Although the Roman Catholic religion is recognized in the constitution as the national religion, church and state are practically separate. The people are mostly Catholic, but the influence of the church is declining, particularly among the men. There are no large holdings of land or other wealth in the hands of the church or of religious orders.

Political Organization

Politically Santo Domingo is a republic, at least in name, with the ordinary legislative, executive, and judicial branches. The chief executive is the President. His cabinet comprises the secretaries who head the seven departments. The national congress consists of a senate and a chamber of deputies. The country is divided into twelve provinces, which are subdivided into 65 communes. The provincial governments are of little importance. Their functions are primarily military, and they have little to do with the civil government. Their governors are appointed by the President. Before the American occupation they were usually local chiefs or bandits who, through their control of the military system, were largely independent of and often in revolt against the national government. The communes are the seats of local government, though they have less autonomy than the towns and counties of the United States. Their organization and functions are prescribed by the national constitution and laws, and the national government exercises a good deal of control over local affairs.

The People

The Dominicans are an interesting people—a mixed race of Spanish and negro blood with a strain of the Indian. They are kindly, courteous, and friendly, with many admirable qualities. Their wants are few, and their lives are simple. Contrary to the popular impression created by their unsavory record of revolution and disorder, they are generally of a most peaceful disposition. But among them is a sufficient number of the lawless and violent to keep the country in turmoil. These are the bandits, whose operations have continued to some extent even under the American occupation. They are the material which furnished the "generals" and "presidents" in the former days of independence. This small class is probably the only element of the population which is not satisfied with American rule. But until this generation has passed away, restoration of independence would almost certainly bring a recrudescence of the old disorders.

NATIONAL FINANCE

To the student of public finance the Dominican Republic offers a field of unusual interest. In no other aspect of their national life did the Dominicans exhibit to such a degree their failure in self-government. In fact it is no exaggeration to say that finance was the rock upon which their ship of state was wrecked. Their tax system, resting almost exclusively upon customs and excise duties, bore no slightest mark of an attempt to distribute justly the costs of government. Public expenditures were made in the interests of the group of "patriots" for the time being in control of the government and wholly without regard to the development of the nation or the welfare of its people. It was the revenues of the customhouse that furnished the bone of contention for revolutionists and rival presidents. It was disregard of the obligations of its national debt that brought the country into conflict with the governments of its European creditors in 1904 and led to the agreements of 1905 and 1907 under which the United States took charge of the customs administration and the national debt. And finally, failure to live up to the financial terms of this agreement and collapse of the internal revenue system were the chief causes of the intervention of the United States in 1916.

The national revenues in the year 1916 amounted to $4,709,518. Of this total, $4,035,355, or 86 per cent, came from customs taxes, including duties on exports as well as imports. The customs, being since 1905 in the hands of the American Customs Receivership, presented the unique spectacle of an honest and efficient administration, with correspondingly large returns. Other parts of the revenue system were in the hands of the Dominicans. Excise taxes, of a bewildering variety, produced $401,757, less than 9 per cent of the total revenues. License and business taxes yielded the small sum of $201,178, and all other sources together produced the remaining $71,228.

The most significant feature of this revenue system is the complete reliance upon indirect taxes. We look in vain for anything in the way of a property tax or an income tax. No attempt had apparently ever been made to adjust the burdens of taxation to the ability of the people to pay. The indirect taxes were mainly on necessities of life, as such taxes must always be if they are to yield a large revenue. Such taxes are notoriously a burden upon the poor, their pressure growing constantly lighter as we ascend the scale of economic well-being. It was perfectly evident that their taxes added much to the cost of living and put many important articles practically out of the reach of the mass of the people. Such taxes are also a check upon business and an obstacle to the economic development of the country. On account of the efficient administration of the heavy customs duties, and in spite of the lax management of the rest of the tax system, the total of the national revenues was actually a large amount in consideration of the circumstances of the country. An annual revenue of $5,000,000 was contributed by a population of probably not over 500,000 or 700,000. That meant a per capita tax of seven to ten dollars—a heavy burden in view of the poverty of the people and the country's backward economic development.

The finances of the provinces are of little importance. They have no independent sources of revenue and receive no contributions from the communes. Their wants, consisting of a few salaries and office expenses, are met directly out of the national budget.

FIG. 10—Eastern bank of the Ozama River, Santo Domingo City. (Photograph by the late Theodoor de Booy.)

MUNICIPAL FINANCE

The communes of Santo Domingo enjoy the most extraordinary revenue system that the present writer has ever met. There are no official reports of communal finance. Through the kindness of the National Controller General the writer secured reports from nearly all the communes covering the revenues of 1916 and the budget estimates of 1917. From these reports it was possible to identify some 33 different kinds of revenue, besides an unknown collection masked under the title of "miscellaneous." The total revenues in 1916 were $750,000. Nearly half came from licenses and business taxes. Almost half the balance was from customs and octroi duties. There was almost nothing in the way of direct taxes. Among the monstrosities in this bewildering collection, we note a communal customs tariff on goods imported into the country, which is entirely independent of the national customs. Each commune imposes its own rates, which of course tend to destroy the character of the national tariff system and add greatly to its burdens. There are a communal export tax on sugar and a system of communal port dues. The license and business taxes stretch their deadly tentacles over a great number of occupations and are a heavy burden on industry. In the whole local system it would be hard to find a single example of sound taxation.

EFFECTS OF AMERICAN OCCUPATION

In the three years of American occupation, the Military Government has gone far in justifying its presence, even in the eyes of the Dominicans themselves. With some occasional lapses law and order have been maintained throughout the greater part of the country. The cities and adjacent country districts are as safe as any American community. The control of the national government, particularly the finances, has removed the chief inducement to revolutionary uprisings. Apparently the great majority of the Dominicans are well pleased with the results and would be the first to protest against a return to independence and lawlessness.

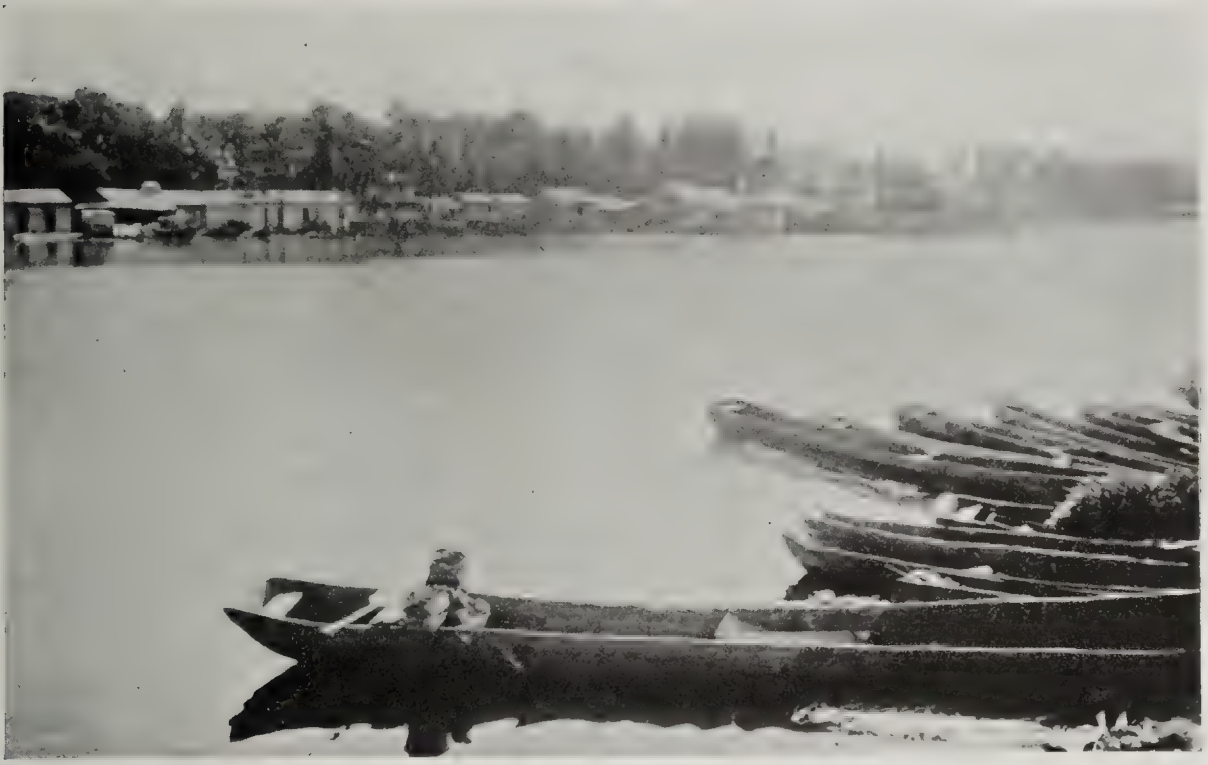

FIG. 11—Native boats on the Ozama River at Santo Domingo City. (These boats are dugouts: they bring charcoal and country produce to the city market.)

The Military Government is taking an active and intelligent interest in every phase of national development. Agriculture is being promoted by experiment stations, agricultural education, and the dissemination of information among the people. In every branch of industry the Government is seeking to aid the people to develop intelligently the national resources. The discouraging problem of public education has been vigorously attacked. Finally the two directions in which the Military Government shows the most important results are public works and finance.

Mention has been made of the poverty of transportation facilities. The problem of good roads was one of the first to which the Military Government set itself. Practically all the progress that has been made in modern road building is due to its efforts, and it is rapidly pushing forward the execution of a broad plan for a national system of highways. Nothing could possibly be of greater immediate service to the nation. The Military Government has also taken hold of the Dominican Railroad and is putting it into shape for efficient service. Improvements in harbors, construction of docks and customhouses, and installation of machinery for loading and unloading ships are other examples of an intelligent policy of public works. The cost of these improvements is being met out of the Dominican revenues, which have shown a healthy growth under American occupation.

Reform of the Financial System

As finance was the Dominicans' worst stumbling block, so finance offers the Military Government its greatest opportunity for service. Even before the American occupation the national debt had been put on a sound foundation, and the customs faithfully administered, through the good offices of the United States. Under the control of the Customs Receivership, customs revenues increased from $2,500,000 in 1905–1906 to $5,333,000 in 1917, though the war's interference with foreign commerce caused a decline of about $1,000,000 in 1918. The occupation of 1916 gave the Military Government an opportunity to show what could be done by equally honest and efficient administration of the internal revenue system. The revenue from this source was $674,000 in 1916. Next year it nearly doubled ($1,234,000), and in 1918 it was $1,701,000. The total gross revenues in 1918 were over $6,000,000. Besides administrative improvements the Military Government has changed the customs and internal revenue laws so as to render them more equitable and less burdensome on the country's trade and industry.

The most important change in the fiscal system was the introduction of a national property tax (promulgated April 19, 1919). The law places a tax upon land and permanent improvements, including industrial machinery, railroad and mining equipment, and ships, and a tax upon titles to undivided lands. Lands are taxed at progressive rates from one-half of one per cent to two per cent, according to area. The rate on improvements is one-fourth of one per cent. Titles are taxed five cents on each *peso* or other unit. On the subject of land titles something will be said later.

The reform most needed in the Dominican tax system was the substitution of direct taxation for much of the prevailing mass of indirect taxes and licenses. The property tax was the logical remedy. The income tax would have no opportunity among a people of such general poverty. Practically the entire wealth of the country is in the form of land and natural resources connected with the land. This wealth the new tax seeks to reach. The writer cannot approve of the progressive rate of the land tax, and the discrimination in favor of improvements smacks a bit too much of the single tax. But, on the whole, the measure is a wise one. It marks a long step forward on the road to sound taxation and industrial progress.

THE PROBLEM OF LAND TITLES

Of all the problems before the Military Government the most difficult is that which has to do with the extraordinary condition of land titles in the Dominican Republic. This is a subject which has never received adequate study. Its maze of historical ramifications and legal technicalities is both fascinating and bewildering. It is not possible here to present more than a brief general summary of the historical development and present status of land titles.

Land titles in Santo Domingo are in a state of chaos. It is safe to say that in the whole country there is not a single perfect title, as we understand the matter. The original grants were made in the distant past and are shrouded in mystery. There has never been a system of recording titles that deserves the name. At different times the country has been under the rule of Spain, France, Haiti, and numerous Dominican "republics." Each has done its best to undo the work of its predecessors and destroy their records. When to this situation is added an almost "continuous performance" of revolutions and bandit forays, one can readily understand the fate that has befallen most of the records, kept in the palm huts of the village notaries. Records of original grants as well as of later transfers have generally been lost or destroyed.

But this is not the worst of it. The most serious difficulties arise from the peculiar system of common lands (*terrenos comuneros*), which are tracts owned in common by a number of persons without division among the owners. These communal lands appear to have had their origin in the period of the Spanish Government. The crown granted to various persons large tracts, whose boundaries were described more or less indefinitely by reference to geographical features, such as the sea, a river, a range of mountains, etc.; the geographical names employed were those in common use among the natives at the time. When the owner of a grant died, it was not customary to divide the land among his heirs. Instead a notary public was employed to set a money value upon the whole tract and to give to each heir a title of a certain money value representing his share of the whole. These shares, expressed in *pesos*, are known as "*acciones*" or "*peso* titles." The device may be understood by comparing it with the ordinary joint stock corporation, in which each share represents the stockholders' undivided interest in the rights of the whole corporation.

When the owner of *peso* titles died his share would be distributed among his heirs without any division of the land, and so on for generation after generation. *Peso* titles were sold from time to time, without specifying any particular part of the original tract as passing to the purchaser. Loss and destruction of records of these transactions made a bad matter worse.

There was also wholesale fraud, opportunity for which is obvious. An owner frequently sold to different purchasers titles whose aggregate was many times his entire share. Counterfeit titles have been manufactured, often with the aid of dishonest notaries, and sold in large quantities to trusting purchasers.

The result of centuries of this sort of thing is a chaos of land titles which beggars description. No land survey has ever been made. Most of the land is in these undivided tracts. The country is flooded with *peso* titles, some genuine, some counterfeit, and none free from suspicion. The *peso* values stated in the titles bear no relation whatever to the value of the land; and it is often impossible, from the wording of any particular *peso* title, to locate exactly the land to which it refers.

Occupation of land and ownership of land titles have little connection with each other. Many owners of *peso* titles have never occupied the lands to which their titles refer. Others have occupied and cultivated parts of their tract with scant regard to the rights of the other *peso* owners. Still other "squatters" are in possession of lands to which they have no title whatever. Land is so abundant that this sort of informal possession has grown up easily. It is almost impossible to decide as between the present rights of squatters and of title holders. The Dominican laws on the subject are not clear, particularly with reference to *terrenos comuneros*.

Occasional efforts have been made to clear up the tangle of land titles. Back in the middle of the eighteenth century, disputes between co-owners and between owners and squatters led to the appointment of a judge to examine titles and protect the legitimate owners. But little was accomplished; and the new titles, *amparos reales*, issued to certain owners, only served to add to the confusion. Recently the Dominican Congress, in 1912 and 1915, has taken a hand and passed certain laws. This legislation was ambiguous, has not been enforced, and has accomplished nothing.

The whole problem is thus handed on to the Military Government. It has shown some natural hesitation to tackle the gigantic task. But the obligation could not be avoided. If for no other reason, the new property tax will never function satisfactorily with land titles in their present state. The Government now has a commission investigating the whole subject, and at last the problem appears to be on the road to settlement. Nothing that could be done would go farther to promote sound finance, to encourage investment of capital and business development, and to justify the presence of the military power of the United States.

FORESTS AND HUMAN PROGRESS

By Raphael Zon

U. S. Forest Service

Forests have had an important effect on the distribution of mankind over the earth's surface. They have deeply affected the spiritual and religious life of the tribes living within them or near by. They have been a source of raw material indispensable to the economic development of the human race. The relations between forests and man are manifold and varied throughout the course of human progress from the primitive stage to the present highly developed economic organization.

There may be recognized three stages in the relation of man to forests:

(1) Civilization dominated by forests.
(2) Civilization overcoming the forests.
(3) Civilization dominating forests.

Just as we had the stone age, the bronze age, and the iron age at the same time in different parts of the earth, so we have simultaneously the three stages of the relation of man to the forest. Thus in central Africa and South America man in his relation to the surrounding forest is in the first stage; in a considerable part of North America and in Asia he is in the second; and in Europe and in parts of the United States he is already in the third.

Civilization Dominated by Forests

If no attempt is made to go back into the mode of life of our simian ancestors, whose abode must have been the forest,[1] and our survey is confined to the beginnings of civilization in Europe, Asia, and America, one fact stands out clearly; namely, that the forests in the early stages of human progress did not offer favorable conditions for the settlement of primitive man; on the contrary, they were always an element inimical to the spread of mankind over the earth.[2]

The first and most striking evidence that this is so is the fact that only few traces of prehistoric man are found in densely forested regions. The chief memorials of Neolithic man in Britain, for instance, are found on the moorlands which in these ancient times appeared as islands of open habitable land above the vast stretches of swamp and forests.[3] A study of the occurrence of human settlement from the earliest Stone Age tells the same story, namely, that the cradle of human civilization was not a primeval forest.

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[1] Attention, however, may be called to Barrell's thesis that desiccation and reduction of the forest (central Asia) acted upon our simian ancestors as a controlling factor in the evolution towards man (Joseph Barrell: Probable Relations of Climatic Change to the Origin of the Tertiary Ape-Man, *Scientific Monthly*, Vol. 4, 1917, pp. 16–26).

[2] Robert Gradmann: Das mitteleuropäische Landschaftsbild nach seiner geschichtlichen Entwicklung, *Geogr. Zeitschr.*, Leipzig, Vol. 7, 1901, pp. 361–377; reference on p. 366.

Karl Sapper: Die mittelamerikanische Landschaft, *Geogr. Zeitschr.*, Vol. 8, 1902, pp. 489–515; reference on p. 492.

[3] H. J. Fleure, Racial History of the British People, *Geogr. Rev.*, Vol. 5, 1918, pp. 216–231; map on p. 219.

The first great nuclei of population, the seats of the earliest recorded civilizations both in the Old and in the New World, originated in arid regions, at best only scantily covered with forest.[4] In the Old World the Egyptian, Babylonian, Assyrian, and Phoenician civilizations arose in hot and dry regions in climate not unlike southern Arizona and New Mexico. Within the "rainless belt" extending across North Africa, Arabia, Persia, and on through Tibet into Mongolia, or from the borders of it, have come all the conquering races of the Old World.

Similarly in the New World the nations which developed a high degree of civilization were those in the arid regions of Mexico and Peru—the Aztecs and the Incas.[5]

Primeval Forests an Obstacle to Human Migration and Colonization

Forests have acted as barriers to human colonization in all parts of the world. In the Alleghanies as well as in tropical West Africa[6] the forest for many decades delayed the penetration of the white man into the interior of the continent. It took the American colonists about 200 years to reach the crest of the Appalachians.[7] It prevented the spread of the Hamites[8] from North Africa southward and stopped the movement into the Congo region of the cattle-keeping aristocracies such as the Bahima which had a social, political, and military organization superior to other tribes. In the heart of the Congo forest no traces of an ancient population have been found. All evidence points to the comparatively recent penetration of man.[9] The expansion of the Inca Empire from the high plateaus of Peru and Bolivia eastward was limited by the impenetrable forests of the headwaters of the Amazon River.[10] Attempts to penetrate down the eastern valleys brought feeble results. In contrast is the southward expansion of the Empire—to or beyond the river Maule—by roads where neither the frigid heights of the Cordillera nor the inhospitable desert proved so formidable as the barrier of the forest. The history of the Spanish conquest is similar: the forest continued to mark the boundary of effective control. Indeed much the same is true today.

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[4] Paul Vidal de la Blache: La répartition des hommes sur le globe, *Ann. de Géogr.*, Vol. 26, 1917, pp. 81–93 and 241–254; *idem:* Les grandes agglomérations humaines: (1) Afrique et Asie, *ibid.*, pp. 401–422 (abstracted in the *Geogr. Rev.*, Vol. 7, 1919, pp. 52–53).

[5] Remains of the Maya civilization are now found in the dense tropical forest. Huntington however suggests that this civilization arose and flourished during a time of drier climate. The succeeding moister period favored the growth of that type of heavy forest so inimical to human progress. Ellsworth Huntington: The Climatic Factor as Illustrated in Arid America, *Carnegie Instn. Publ. No. 192*, Washington, D. C., 1914.

[6] Siegfried Passarge: Die natürlichen Landschaften Afrikas, *Petermanns Mitt.*, Vol. 54, 1908, pp. 182–188, reference on p. 186.

[7] M. K. Genthe: Die geographischen Grundlagen der amerikanischen Geschichte, *Geogr. Zeitschr.*, Vol. 15, 1909, pp. 386–408; reference on p. 390.

[8] Emmanuel de Martonne: La vie des peuples du haut Nil, *Ann. de Géogr.*, Vol. 5, 1895–96, pp. 506–521; Vol. 6, 1897, pp. 61–70; reference on p. 63.

[9] Sir H. H. Johnston: A Survey of the Ethnography of Africa, *Journ. Royal Anthropol. Inst.*, Vol. 43, 1913, pp. 375–421; reference on p. 396.

[10] Alfred Hettner: Regenverteilung, Pflanzendecke und Besiedlung der tropischen Anden, in "Festschrift Ferdinand Freiherrn von Richthofen," Berlin, 1893, pp. 197–233; reference on p. 229.

The Ancient European Forests

The Romans, the greatest colonizers of olden times, were forced to stop in their expansion and Empire building at the boundaries of the dense, virgin German forests whose inhospitable and somber nature was pictured in dark colors by such ancient writers as Tacitus,[11] Pomponius Mella,[12] and Marcellinus,[13] who spoke of the forests as of something horrid and inaccessible and unsuited for human habitation. The more recent European historians, such as Gradmann[14] for instance, consider the boundary of the Roman Empire as coinciding with the western boundary of the coniferous forests of southern Germany. The strategic genius of the old Romans clearly perceived that it was not the German mountains themselves, which were only moderate in height, that formed the bulwark of the ancient Teutonic freedom but the vast primeval forests with which they were clothed. In their writings they referred to the *saltus* (break or forest) and not to the Montes Germaniæ.

Just as the Romans were compelled to stop in their colonizing activities at the boundary of the virgin forests of central Europe, so the successive later waves of the nomadic tribes which moved from the eastern prairies westward—Huns, Magyars, Avars, and the like—broke up when they reached the barrier of primeval forests. The routes of migration in western and central Europe were largely determined by the openings in the primeval forests.[15]

The difficulty with which primeval forests could be penetrated made them always an obstacle to all great historic migrations of man. On the grasslands pack animals could be used, and here the wheeled cart originated. In the primeval forest where a path must be hacked out with the aid of ax and knife man must be his own burden bearer.[16] Three or four miles a day is the average rate of travel in such forests. Not infrequently man depends here on the animal trails. Mammoth and rhinoceros in the ages past were the first trail builders in the forests of central Europe, just as the elephants are breaking trails now in the African and eastern Asiatic forests to be later followed by man. The bear trails served as roads for the Teutons in the primeval forests of Europe, just as they are now doing in the forests of

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[11] Silvis horrida, paludinibus foeda (*Germania*, 5).

[12] Terra montibus aspera, silvis ac paludinibus invia (*De Chorographia*, 3, 3).

[13] Horrore silvarum squalentium inaccessum (*Rerum Gestarum Liber*, 15, 4).

[14] Robert Gradmann: Der obergermanisch-rätische Limes und das fränkische Nadelholzgebiet, *Petermanns Mitt.*, Vol. 45, 1899, pp. 57–66.

[15] Paul Vidal de la Blache: La France—Tableau géographique, Paris, 1908, p. 29 and accompanying map.

[16] Georg Dressler: Fusspfad und Weg geographisch betrachtet, *Mitt. des Vereins für Erdkunde zu Leipzig* Vol. 45, 1905, pp. 137–239; reference on pp. 176–181.

Kamchatka and Siberia for the hunters of fur animals.[17] In North America, a Humboldt remarks, the "bison pointed out to man the best roads through the Cumberland Mountains." In medieval Europe the wild cattle broke the first trails in the forest, just as in our own western forests the cattle trails were the first which many of us traveled.

Forests of the North

In the northern forests the main obstacles to the movement of man are vast swamps and muskegs. In winter the snow cover usually improves the facilities for movement. Light sleds, skis, and snowshoes are then the chief means of travel.[18] In summer, however, this advantage of the northern forest over the tropical one is lost, and it is necessary to use the rivers for roads. Where these rivers are often interrupted by rapids or falls, light transportable canoes had to be used, as they are still being used by the North American Indians. Such means of transportation, although they are of great help, are not, of course, sufficient or adequate for easy communication. For this reason all world trade routes have always kept away from virgin forest regions. Not a single transcontinental railroad has yet been cut through the forest region of the Amazon or Congo, and such railroads as the Trans-Siberian and the Canadian Pacific skirt only the southern boundaries of the virgin boreal forests.

Middendorff [19] in his travel through eastern Siberia was surprised at the scarcity of wild game, which became abundant only toward the steppes and in the vicinity of human habitation. In his travel through the forests he found an insurmountable obstacle in the vast swamps. In winter when they are frozen over it is possible for men to enter the forest and cut wood, but it is out of the question to establish a permanent dwelling on the unstable ground. The swamp forests, therefore, are not inhabited. Even where the soil is not swampy the foot sinks deep in decaying vegetation, while fallen, dead, or diseased trees lie athwart the dense upright trunks and thus impede movement. Darwin, in his ascent of Mt. Tarn in Tierra del Fuego, encountered difficulties of a similar character.

The records left by ancient writers regarding the primeval forests of central Europe agree with descriptions given by modern travelers of the forests of the north which still remain intact. Pliny presents a picture of the primeval forests of central Europe which is not unlike that given by Middendorff of the primeval forests of eastern and western Siberia. He speaks of gigantic trunks capable of holding up thirty men in the water, of oak roots lifted like arches or forming mounds of earth, and of great islands of wood floating on the rivers; just as the rivers of Siberia today are cumbered with trunks of trees uprooted and accumulated in huge natural rafts, so that to travel even by water is difficult.

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[17] A. T. von Middendorff: Reise in den äussersten Norden und Osten Sibiriens, 4 vols. and atlas, St. Petersburg, 1848–75; reference in Vol. 4.

[18] H. Baulig: Sur la distribution des moyens de transport et de circulation chez les indigènes de l'Amérique du Nord, *Ann. de Géogr.*, Vol. 17, 1908, pp. 433–456.

[19] Middendorff, *op. cit.*

Dense, extensive forests are perhaps the most formidable of natural barriers. Areas which otherwise would be easy of access, become unfriendly and inaccessible when covered with high and dense forest vegetation. Mountain slopes which if cleared would be accessible are inaccessible when covered with a dense forest. As Arrigo Lorenzi has pointed out, even the low and twisted forest vegetation characteristic of the dolomite region of the eastern Alps—and that of the San Bernardino Mountains of southern California might also be instanced—presents a serious obstacle to travel.[20]

The Sparse Population of the Forest

Comparison of a map showing the density of population or settlement with one showing the distribution of the principal natural types of vegetation, such as desert, forest, grassland, shows at a glance that the most scattering population is found in the deserts and in the large stretches of primeval forest. This holds true of the northern forests of the temperate region and the tropical forests of the Amazon and of northern Australia, where the density of population is less than one per square mile, as well as of the Congo forest and the primeval forests of southeastern Asia, where the density of population is also very low. This belt of sparse population is clearly distinguished from adjoining prairie or otherwise treeless regions, where the density is considerably greater. Similar maps, only on a larger scale, for individual countries show that the timbered belt in the mountains has a thin population while the valleys below are densely populated.[21] Even the alpine meadows above the timber line may have a denser though temporary population. In the timbered belt are found only a few huts of hunters and wood-choppers.

A primeval forest at the lower stages of human civilization is of little importance as a source of trade. The local demand for wood material is fully supplied from the fringes of the forest region. The export of large quantities of wood is out of the question because demand and means of transportation are lacking. There remains only hunting and grazing. It is true that throughout the Middle Ages hunting and pasturing of swine in the forest were not insignificant sources of revenue to many a king. This, however, was also possible only on the outskirts since the interior of the dense and dark primeval forests is unfavorable even for wild animals. Every one who has traveled through the virgin Douglas fir forest of Puget Sound has been impressed by the lack of animal and bird life. An occasional squirrel or chipmunk is about all that one is likely to see for days. The primeval forests of Asiatic Russia, the so-called Siberian *taiga*, and the tropical *selvas* of South America support very few wild animals. This is less true of temperate broad-leaved forests where abundant mast of beech and oak furnish food for animals and often for men. Such poverty and inaccessibility of the virgin tropical and northern coniferous forests make them almost entirely unsuited to human settlement. In the early colonial history of America the virgin forest was in the true sense of the word "No Man's Land."

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[20] Arrigo Lorenzi: L'uomo e le foreste, *Riv. Geogr. Italiana*, Florence, Vol. 25, 1918, pp. 141–165, 213–242; Vol. 26, 1919, pp. 47–57. Special mention should be made of this suggestive study to which the writer is indebted for several of the instances used in this paper.

[21] For an admirable illustration from the Austrian Alps see the maps of population (Pl. 11) and use of the land (Pl. 10) in Norbert Krebs: Länderkunde der österreichischen Alpen, Stuttgart, 1913.

Forests as Territorial Boundaries

The difficulty of traveling in the forests made them play, at the lower stages of human culture, the part of territorial boundaries. A wide forest belt served the purpose of defense against attack from a neighboring tribe or nation better than does the boundary line of the modern state.[22] This explains the existence of many forests as political boundaries in the ancient nations of central Europe. Classical examples of the function of the forests as political boundaries are afforded by the forests of the mountain ranges of central Germany, which, according to the description by Julius Caesar, extended for a distance of 9 days' travel in width and 60 in length and first separated the settlements of the Celts from those of the Teutons[23] and later became the boundary between northern and southern Germany. The outside boundaries of the ancient Teuton Empire were the forest-covered mountains of the Ardennes and Vosges,[24] which from the Carolingian time until the twelfth century served as the most effective defense against attacks from the west; and the Bohemian, Silesian, and Pomeranian forests provided a similar protection on the east.[25] In the same way, what is now Austria and once was a part of the ancient German Empire, was separated from Hungary and protected from attacks by the Hungarian hordes, not by the narrow Leitha River, but by the wide belt of mountain forests and the forest-covered valleys that lay between the mountain chains.[26] Primeval forests which extended as far as the Danube had served also as political boundaries separating the old German province of Austria from Bohemia.[27] According to Grimm, the German word *Mark*, which means boundary, was originally a synonym for *Waldland*, or woodland.[28] The old Romans also considered forest and boundary as synonymous terms, and the God Sylvanus was the protector of both. Many other examples of the same kind can be mentioned.

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[22] Julius Lippert: Social-Geschichte Böhmens in vorhussitisches Zeit, 2 vols., Vienna, 1896–98; reference in Vol. 1, p. 24.

[23] Heinrich Kiepert: Lehrbuch der alten Geographie, Berlin, 1878; reference on p. 535.

[24] Vidal de la Blache: La France, p. 177. See also pp. 30–31 on the rôle of the forest in the establishment of ancient boundaries. And see Albert Demangeon: La Picardie, Paris, 1905, pp. 425–435.

[25] H. F. Helmolt: Die Entwickelung der Grenzlinie aus dem Grenzsaume im alten Deutschland, *Historisches Jahrbuch. Im Auftrage der Görres-Gesell.*, Munich, Vol. 17, 1896, pp. 235–264.

[26] Robert Sieger: Die Grenzen Nieder-Österreichs, *Jahrbuch für Landeskunde von Niederösterreich*, Vol. 1, 1920, pp. 183 and 207.

[27] Alfred Hackel: Die Besiedlungsverhältnisse des oberösterreichischen Mühlviertels, *Forschungen zur Deutschen Landes und Volkskunde*, Stuttgart, Vol. 14, 1903, pp. 1–77; reference on p. 37.

[28] Heinrich Nissen: Italische Landeskunde, 2 vols., Berlin, 1883 and 1902; reference in Vol. 1, p. 43.

Thus the forests served as political boundaries between the Franconian, Swabian, and Hessian possessions, between Gaelic and Breton holdings. The forest district of the "Weald" separated the Anglo-Saxon territories of Kent and Sussex.[29] The Norwegians consider the sparsely inhabited forest belt which lies south of latitude 62° N. between their own and Swedish territories as the "most natural political boundary."[30]

If in Europe at present there remain only traces of the historic significance of forests as state and political boundaries, in other parts of the world, especially among the more primitive races, this function of the forests stands out very clearly. Thus in central Africa, according to many explorers, the areas which serve as boundaries between the native tribes are always void of human settlements because, for the most part, they are forest-covered. The most striking demonstration of this is found in the 160-day journey of Stanley in the forest region of the Congo and also in the travels of Junker over the divide between the Nile and the Congo. Junker records an interesting observation, namely, that the tribes are wilder and less cultured in proportion to the width of the forest belts which act as boundaries separating one tribe from another. Thus the Niam-Niam region in Africa in the north is separated from that of the Nile negroes by a thick forest belt 25 miles broad. In the Kassai region of the Congo, Wolf found a state surrounded on all sides by a wide belt of primeval forest. On the Islands of Oceania there are village communities which are hidden almost entirely from the traveler by dense mangrove forests.[31]

Forests as Boundaries in North America

The forests have also played the part of territorial boundaries for many Indian tribes of North America. Before the advent of the white man on this continent each nation, or tribe, occupied a definite territory separated from the territories of the other Indian nations.[32] It was only after the white man came to the continent and after some of the Indian tribes, like the Sioux in the plains, had secured horses that the Indian nations, under the pressure of the white man, acquired nomadic habits. Practically all of the North American Indians had their settlements outside of the forest, either along lakes and rivers or on high plateaus free of timber, in the woodland and lowland type, or in the plains.

Although the aboriginal settlements were not established in the forests and the forests acted as barriers to migration, they were too necessary to the Indian—furnishing him with food, clothing, canoes, etc.—to be wholly avoided. There is no doubt, however, that he regarded the forest with fear and superstition. The Indian greatly feared the spirits of the dead, and since many of the Indian tribes placed their dead in canoes in the forks of trees or on high poles, it was only natural for them to believe the forests to be haunted. In traveling to and fro, the Indian avoided the deeper forests, following streams as much as possible, though when necessary he crossed the forest in search of food or to make war. The hunting lots or territories of many of the Indian tribes were more or less fixed tracts of country, whose boundaries were determined by natural landmarks, mostly by forests. In an article in *Harper's Magazine* for 1869 Edward T. Coleman, in describing his ascent of Mt. Baker, relates a story which may be indicative of the part which the forest played as the boundary line between the different Indian tribes:

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[29] Vidal de la Blache: La France, p. 31.

[30] Hans Reusch: Norwegens Verhältnis zu Schweden vom geographischen Gesichtspunkte aus, *Geogr. Zeitschr.*, Vol. 11, 1905, pp. 425–435.

[31] Richard Mahler: Siedelungsgebiet und Siedelungslage in Ozeanien, Suppl. to *Internatl. Archiv. für Ethnogr.*, Leiden, Vol. 11, 1898.

[32] J. W. Powell: Indian Linguistic Families of America North of Mexico, *7th Ann. Rept. Bur. of Ethnol.*, 1885–86, pp. 1–142.

> The Indians soon came back to camp in great wrath, occasioned by the discovery of a piece of wood cut by an ax. This trace of man in such a desolate and uninhabitable country deeply interested me but had a violent effect on my savage companions. They explained that the Thompson River Indians had evidently been poaching on their hunting grounds.

The Yakima Indians living on the eastern slope of the Cascades and the Puget Sound Indians were divided by a forest belt of about 50 miles in width, which they thought was haunted by "stick" Indians. The wide forest belt acted as a barrier between the two, although there were some trails over the low passes.[33]

It is interesting to note in the diary of Lewis and Clark in their trip across the continent that the only time they did not meet Indian tribes was when for nine days they crossed the lodgepole pine forests of Montana.

THE FOREST AS REFUGE OF MAN

The mere fact that there are races and tribes which live exclusively within the primeval forests shows, of course, that although the forest on the whole is inhospitable to human settlement it is not entirely prohibitive. The very reasons for which man in most cases avoids the forests as a place for permanent settlement may attract some people, who, for one reason or another, at their own will or otherwise, shun the densely populated communities which are found largely in the open valleys. Some religious fanatics go into the woods in order to withdraw themselves from the sinful world. Criminals hide in its remote interior in order to escape the strong arm of the law. Brigandage in Corsica has been encouraged by the dense *maquis* with which at least half the island is covered and which afforded the brigands a safe shelter from any punishment by law. The activities of Robin Hood in Sherwood Forest, which still linger in our memory from boyhood days, illustrate the point. The moonshiners of Tennessee and Kentucky afford an example nearer home.

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[33] George Gibbs: Tribes of Western Washington and Northwestern Oregon, *Contributions to North American Ethnology*, Washington, 1877, Vol. 1, pp. 157–241.

The primeval forests extend their dark and safe covering not only to outlaws of human society, but also to large groups of people who may seek new life under conditions which they could not obtain in the older communities. The Quakers in North America and several religious sects of Russia have found in the forests their freedom of religion, and the Wends [34] in the forests of the River Spree have retained up to the present their Slavonic language which they did not wish to give up.

Primitive forms of worship protected by the forests long withstood the advance of Christianity, and even at the time of Petrarch "the ancient Prussians, in honor of their gods, burned the Knights of the Order that fell into their hands." Near Treves, according to Turonese, the worship of Diana in the depths of the forest lasted into the fifth century. Under the protection of their pine forests and wooded swamps the barbarian Lithuanians and Finns preserved not only their racial integrity but also their archaic language. In Flanders the Houtland (country of forests) up to an advanced period of history was occupied by forest tribes of a Lappish type who grazed their flocks in the natural openings of the forest. The so-called *bosschkerle* (bushmen) are the present representatives of these races.

When forests did not afford a safe defense in themselves then the natives resorted to the construction of additional barriers, which, primitive as they may seem to us at present, probably proved very effective for those times. Thus, for instance, many tribes would fell large quantities of timber, producing conditions similar to windfalls and in this way hamper the movement of warring neighbors. Such artificial defenses constructed in the forest and with the aid of timber were used for instance among the ancient Etruscans, Celts, Teutons,[35] and even in the Middle Ages among the Slavs in Bohemia and Silesia; and according to Stanley's[36] testimony even now such artificially constructed barriers are found among the natives of the Congo region, and they are reported from Borneo.[37]

In Caesar's Commentaries many references are found to the important part played by the forests in the resistance of the Gauls. The struggle against the Atrebates, the Nervii, and the Viromandui gives Caesar occasion to describe the singular "hedges" made of branches of trees and thorny plants with which the Nervii opposed the advancing cavalry. The *plexicium* of later days was a sort of live hedge similar to that of the Nervii. Both defensive arrangements were intended to supplement and reinforce the natural living rampart. It was only because of the forests that the Transalpine Iapydes resisted successfully and for a long time the invasion of the

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[34] Albrecht Penck: Das Deutsche Reich, Vienna and Leipzig, 1887, p. 521. (Unser Wissen von der Erde, Vol. 2, Part I, Länderkunde des Erdteils Europa.)

[35] Friedrich Ratzel: Politische Geographie, 2d edit., Munich and Berlin, 1903; reference on p. 549.

[36] Sir H. M. Stanley: In Darkest Africa, 2 vols., London, 1890; reference in Vol. 1, pp. 78, 79.

Muller: Die Staatenbildungen des oberen Uelle-und Zwischenseengebietes, Leipzig, 1897, p. 66.

[37] Friedrich Ratzel: Der Ursprung und die Wanderungen der Völker geographisch betrachtet, *Berichte über die Verhandlungen der Königlich Sächsischen Gesell. der Wiss. zu Leipzig, Phil.-Hist. Klasse*, Vol. 50, 1898, pp. 1–75 and Vol. 52, 1900, pp. 23–147; reference in Vol. 52, p. 28.

Romans. Appian describes the way in which they made use of felled trees to hinder the advance of the Romans. In northern Italy also the Cisalpine Gauls struggled bitterly against the Romans, taking advantage of the forests. The praetorian Manlius, according to Livy, was surprised at two points where the road passed through wooded territory, and only with great difficulty and after severe losses did he succeed in getting through to the open country and joining Tanetus. Livy also tells how during the second Punic War the Boii cut the trees of the vast forest of Litana at the right and left of the road they were traveling, in such a way, that while the trees remained upright the slightest push would cause them to fall. This trap inflicted great losses on the Roman army.[38]

Primitive and Weak Tribes Relegated to the Forest

Alsatian legends record savage peoples relegated by civilization to the forests, where they finally disappeared. Similarly, in the local legends about the Silvani (forest dwellers) or Pagani (pagans) traces may be found of savage races who, hiding in the forests and on the high mountains, resisted the civilization which penetrated to the valleys of Carnic Alps.[39] The same also happens constantly among primitive tribes. Some small tribe threatened or conquered by a stronger one escapes from the danger of the stronger tribe or the yoke of the conquerors by moving away to the inaccessible jungles of the forest. The forests have thus given rise to the formation of small communities made up of refugees, wanderers, and small tribes which have split off from the larger tribes. It is into the dark primeval forest that one must go if one wants to study the Akkas and Batwas of Africa, the Veddas of India, the Kubus of Sumatra,[40] the Alfuros of the Celebes, the Negritos in the Philippines, the Ainus on Yezo, and the Botokudos of South America. It is only natural to expect that forest tribes made up of refugees would present a most variable ethnological conglomeration. The linguistic map of the Congo Basin speaks eloquently of the tribal divisions in this region.[41]

Uniform Characteristics and Habits of Forest Tribes

In spite of the ethnological differences of such forest tribes and of their distribution in different parts of the world, far removed one from another, they display common traits throughout. Forest tribes have developed a very characteristic way of building their dwellings. Thus, for instance, the peoples of the Melanesian islands and of New Guinea, and also some tribes of the forests of the Congo region build wooden shelters for 10 or 12 persons, high above the ground, usually at an elevation of 80 to 100 feet. They construct high platforms upon which the dwellings themselves are placed.[42]

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[38] Lorenzi, *op. cit.*

[39] *Ibid.*

[40] Wilhelm Volz: Die Religionslosigkeit der Kubus, *Petermanns Mitt.*, Vol. 57, 1911, p. 289.

[41] Sir H. H. Johnston: George Grenfell and the Congo, 2 vols., London, 1908. See the ethnographical map of central Africa.

Forest tribes display similar mental characteristics. For instance, all forest aborigines are characterized by an extremely timid, even cowardly, appearance which does not betray in the least their cunning and perfidy. As soon as a traveler turns his back they are ready to send after him a poisoned arrow or spear. The forest makes possible the ambush, the predatory attack, the sortie, and the passive defense. It favors rapid retreat and scattering in small groups, which can then fight from ambush separately or unite for a new attack. Cruelty nearly always accompanies primitive sylvan life.

Economic and Political Life of Forest Tribes

The economic life of such forest tribes likewise presents a uniform simplicity consisting as it does of hunting, fishing, and the collecting of fruits from trees.[43] The gains from such occupation are meager and never certain. In consequence, on the one hand such peoples are physically underdeveloped, and on the other hand cannibalism is most common among them. It is possible that the pygmy races of the primeval tropical forests really became dwarfed as the result of deterioration under the difficult conditions of life in the environment to which they had been driven by a stronger tribe or race. Theodore Roosevelt, in his book on Africa, gives a vivid picture of such a pygmy forest tribe.

The almost entire absence of intercommunication with their neighbors and the consequent narrowness of their intellectual and spiritual horizon is also characteristic of forest tribes. Stanley, for instance, found in equatorial Africa a number of tribes living in the forest that had never heard or known about neighboring settlements, although the latter were only a few miles away from them. Stuhlmann [44] describes graphically the contrasts between conditions in the open country of German East Africa and in the forest where each tiny village is a world to itself.

Political organization among scattered forest settlements is always feeble. Hunting as the chief source of livelihood, with the necessity of wandering about in pursuit of animals, tends to disorganize any large unit. The very scarcity of game alone may hinder any attempt at political organization. The *tribe* is the more usual form of grouping because it represents an intermediate stage between dependence and independence. Even among forest populations at a higher stage of civilization when agriculture in the open places provides a more permanent means of livelihood, political organizations are weakly developed. The tribes of all Gaul separated by vast forest stretches were very slow in uniting against the Romans. The Offensive and Defensive League of the Iroquois Indians, who occupied the territory south of Lake Ontario in the seventeenth century, although greatly feared by their neighbors and a continual menace to the French in Canada, lacked adequate organization.

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[42] Mahler: Work cited in footnote 31; L. Hösel: Über die Lage der Ansiedelungen in Afrika, *Das Ausland*, 1893, pp. 119–121; reference on p. 120.

[43] Ernst Friedrich: Geographie des Welthandels und Weltverkehrs, Jena, 1911, p. 37.

[44] Franz Stuhlmann: Mit Emin Pascha ins Herz von Afrika, Berlin, 1894, p. 423.

Availability of Fuel from the Forest as a Limiting Factor in the Distribution of Man

As a source of fuel the forest has exerted a most powerful influence upon human progress. This influence has been the greater in proportion to the rigor of the climate. A very striking illustration of how the lack of forest-produced fuel has limited the spread of human habitation is contained in the fact that the polar boundary of human settlements in the interior of northern Asia closely coincides with the northern limit of forest vegetation.[45] Although the inhabitants of northern Asia in their nomadic migrations penetrate from time to time into the tundra, as a rule they never go very far from the northern edge of the forest because the forest is the only place where they can find a supply of fuel. Likewise the northern boundary of the settlements of the Indian tribes in America coincides with the polar boundary of the forest.[46] This is strikingly shown in the occurrence of the settlements in Alaska and Labrador. In Alaska the northern timber limit reaches as far as latitude 67° N.; in Labrador it ends at 52° N., or 15 degrees farther southward. The Indian settlements follow closely these fluctuations of the northern timber line. The historic significance of this difference in the northern limit of the forest comes out even more strikingly in comparing the Old and the New Worlds. In the Old World the northern limit of the forest, as well as that of human settlements, extends to latitude 70° N. In eastern North America it stops at 52°. In the New World, with the lowering of the northern forest limit, the historic arena has been pushed southward for from 8 to 10 degrees of latitude.[47] On the contrary, in Alaska, where the northern limit of the forest extends to latitude 67° N. there is a possibility of the development of a mighty community not unlike Sweden or Scotland.

Eskimo Life

Although Indian huts seldom occur beyond the northern limit of the forest, Eskimo settlements are found in the polar archipelago of America. But the settlements there cling to the seashore, for the reason that the sea furnishes them not only with food but also with fuel in the form of timber washed ashore. This explains why some of the islands are more thickly settled than others, as, for instance, the stirking difference in the settlements of Banks Land and the Parry Archipelago. The farther north we ascend along the western shore of Greenland the less driftwood is brought by the sea, and finally, south of the Kennedy Canal, the last driftwood disappears, and with it disappear the last settlements of the most northern Eskimos. The need for wood determines in part certain Eskimo migrations. Thus in the spring Victoria Islanders travel to the mainland and into the interior as far as Great Bear Lake where they obtain material for tent poles and bows.[48] Thus the influence of the forest upon man makes itself felt even many hundred miles away from the nearest forest stand.

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[45] Kurt Hassert: Die Nordpolargrenze der bewohnten und bewohnbaren Erde, Leipzig, 1881, p. 50.

[46] Baulig: Work cited in footnote 18.

[47] Friedrich Ratzel: Die Anwendung des Begriffs "Oekumene" auf geographische Probleme der Gegenwart, *Berichte über die Verhandlungen der Königlich Sächsischen Gesell. der Wiss. zu Leipzig, Phil.-Hist. Klasse,* Vol. 40, 1888, pp. 137–180; reference on p. 175.

The upper timber belt in the mountains has the same significance in limiting the settlements in mountainous regions. Thus in the Alps the highest altitude at which human settlements are still found is close to timber line and never extends beyond 450 or 500 feet above the timber. The Tyrol and the Adamello Alps between Italy and Tyrol are good illustrations of this.[49]

The Forest as a Molder of Spiritual and Religious Life

The forest left a deep impress upon the soul of primitive man. The mysterious twilight of the forest, its gentle rustling, and its weird moaning in storm endowed it with supernatural attributes.[50] The forest figures largely in the religious beliefs of primitive races all over the world. Sometimes trees are regarded as animate, as among the Hidatsa Indians who paid special respect to the shade of the cottonwood, the greatest tree of their territory in the Upper Missouri.[51] By many primitive peoples trees are considered to be the abode of the souls of the dead. According to the Ibo of the Niger delta not only have trees and plants souls of their own but certain trees are supposed to have been selected as the residences of human spirits, and such are held in great reverence.[52] Mention has already been made of the custom of tree burial among certain tribes of North American Indians. Australian tribes also buried their dead in the tops of trees believing that the spirits of the dead wandered therein and also the spirits of the unborn. The latter belief is similarly reflected in the custom known in parts of India where women who wanted to have children arranged religious dances under certain forest trees since these were the home of the children. The Hindu philosopher, Tagore, in his book on "The Realization of Life," describes very vividly the part which the Indian forests have played in the development of Indian civilization and philosophy.

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[48] Vilhjalmur Stefansson: My Life With the Eskimo, New York, 1913, p. 273.

[49] Hermann Reishauer: Höhengrenzen der Vegetation in den Stubaier Alpen und in der Adamello-Gruppe, *Wissenschaftliche Veröffentlichungen des Vereins für Erdkunde zu Leipzig*, Vol. 6, 1904, pp. 1–210. Compare the limit of habitations, pp. 58, 136 with the tree limit, pp. 93, 167.

[50] Oscar Peschel: Völkerkunde, Leipzig, 1877, p. 261.

[51] J. G. Frazer: The Golden Bough. The Magic Art, Vol. 2, pp. 7–58.

[52] A. G. Leonard: The Lower Niger and its Tribes, London, 1906, p. 298.

The influence of the forest upon the spiritual life of man is not confined, however, to primitive tribes. Our ancestors of ancient Europe similarly engaged in tree worship, and relics of it still survive in many ancient customs and superstitions—those attaching to the May tree and the Maypole for example.[53]

THE FOREST IN FOLKLORE, POETRY, AND ART

Folklore, being the most spontaneous creation of the common people, is the best measure of the subtle influence of the forest. The folklore of North American Indian, Teuton, and Slav is permeated with the atmosphere and the joy of the forest. The folk songs are the finest and most vigorous in the regions where the forest has been best preserved. The cycle of stories which center around the lumberjack Paul Bunyon, recently collected by P. S. Lovejoy of the University of Michigan, breathe the atmosphere of the once extensive forests of our country and claim a place in our native American folklore. The words of the old "Crusaders' Hymn," of the year 1200,

> Schön sind die Felder,
> Schöner noch die Wälder

show the feeling of the German people. Many of the heroes of the German sagas, as Siegfried and Parsifal, begin their life in the forest and end it there.

Poetry and drama, although farther removed from the spontaneous reaction of the great majority of the people, still are indicative of the environment which influences the writer. Thus the wonderful forest scenes in *A Midsummer Night's Dream*, *As You Like It*, *The Merry Wives of Windsor*, and other Shakespearean plays could only be written by a man who was an enthusiastic lover of the woods and had lived under the influence of their beauty. Goethe's writings are full of appreciation of the beauty of the forest. We can pick at random such verses as these:

> Schon stand im Nebelkleid die Eiche
> Ein aufgeturmter Riese da.
> Wo Finsterniss aus dem Gesträuche
> Mit hundert Schwarzen Augen sah.[54]

Chateaubriand called the forests *temples primitifs*. He thus speaks of the forest:

> La forêt est sacrée, et ses hautes ramures,
> Où, selon les saisons, le vent prend mille voix,
> Ont éveillé le rêve à leurs vagues murmures
> Et mis l' homme à genoux pour le première fois.[55]

Landscape painting has drawn much inspiration from the forest. First of all, the oaks, beeches, elms, and maples with their delicately arched crowns, then the somber hemlock and spruce, the chaste birch, and the weeping willow—these provided many artists with material for their creations. The majestic forest awesome in its silent, mournful solitude, especially in winter, boisterous in storm, or terrible in the grip of a forest fire will live forever in the paintings of some of the Russian artists of the realistic school.

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[53] Frazer, *op. cit.*, pp. 59–96.

[54] "The oak stood in a garment of mist, a mountainous giant, where darkness peered out of the bushes with a hundred black eyes."

[55] "The forest is holy, and its lofty boughs, on which the winds play a thousand notes, with changing season, by their gentle murmur awaken dreams and bring man to bended knee."

The forest is a great natural structure from which architecture has often borrowed its form. The trunks of the trees gave rise to the pillars of stone, the bending branches served as models for arches, and foliage and flowers provided the ornaments adorning many works of man.

Music has also found inspiration in the dense forest. Enough to mention Mendelssohn-Bartholdy's famous song,

Wer hat dich, du schöner Wald.

Civilization Overcoming the Forest

So much for the influence of the forest upon man. This influence was greatest when mankind was at comparatively low stages of civilization. At a certain stage there begins a reverse influence, namely, that of man upon forests.

Primitive man, possessing crude stone implements only, found but few parts of the earth's surface which were neither too barren nor too heavily forested to be suitable for his habitation. It is true that in recent times societies have to the greatest extent developed, both in size and complexity, in temperate forested regions. This, however, is not inconsistent with the fact that the first large human societies arose, and the primary stages of social development were reached, in arid and treeless climates. The earlier phases of progress had to be passed through where the resistances offered by natural conditions were least; only when the arts of life had been advanced did it become possible for societies to develop in regions where the resistance was greater; and it was only further development in the arts of life, with the further discipline in co-operation accompanying them, that enabled subsequent societies to take root and grow in regions where climatic and other conditions offered relatively great difficulties. At first man is the slave of his environment and only later becomes to a certain extent its master.[56]

FIRST STEPS IN DESTRUCTION OF THE FOREST

The primitive nations could not change to any marked degree the forest cover of the earth. Their tools were too crude, and, moreover, their activity was rarely concentrated at the same place for any length of time because their mode of life was largely nomadic. The primitive agricultural system, caingin making, of the Philippines could never have brought about the destruction of the forests, since the cultivators' efforts were never centered long enough at one place.[57] For this reason the effective influence of man upon the forest in the early days was confined to localities where it existed under very adverse conditions of climate or soil, as for instance on sand dunes, on the edge of the prairie or desert, or at its upper or northern limit. The Batusi and other peoples have encroached on the northeastern edge of the great central African forest. Today Ruanda is practically deforested. The remnants of the ancient forests that remain on the hill tops are regarded as sacred by the natives.[58] In Europe we find that man early succeeded in crowding out the forest in the Mediterranean region, where at best it had a hard struggle to maintain itself. This operation can be traced back even to classical antiquity.

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[56] Buckle brings out this fact strikingly in explaining why a highly civilized nation could have developed in Peru, while in a country situated close to Peru in the same continent and lying in the same latitude (Brazil) there could be found no trace even of the most imperfect civilization. (H. T. Buckle: History of Civilization in England, 2 vols., New York, 1864; reference in Vol. 1, pp. 74–75.)

The dense forests of central Europe did not give way before the efforts of the Romans or the ancient Teutons. Only in the Middle Ages, beginning with the era of Charlemagne, when there arose an imperative need for more room, did the Teutons succeed in clearing any large areas of the dense forests. This clearing was not the work of individuals but was the result of many concentrated and persistent efforts on the part of the religious and knightly orders.

Extent and Character of the Process of Clearing

Some idea of the extent and character of this process may be gleaned from a study of the geographic names of different settlements. There are in Germany alone not less than 6,905 names of places which indicate their origin in forest regions. An analysis of such names reveals also the part which different nationalities have taken in the colonization of forest regions and shows whether settlement took place on open land or on cleared forest land. In Bohemia, for instance, just as in the northern German lowlands, all areas poorly stocked with timber from time immemorial were occupied first by Slavonic nations, which had come to these lands long before the arrival there of the Teutons. The latter, therefore, were forced, as latecomers, to provide for themselves places of habitation amid the dense primeval forest by cutting it off, burning, and clearing the land for fields. In the same way the Romans in colonizing the Alps occupied the open places and left untouched the forested regions of southeastern Austria, which for a long time waited for colonists to come there from Franconia and Thuringia to turn them into fields and orchards. The same story has been repeated in the last century in southern Brazil. The creoles and negroes took possession largely of the prairie sections, leaving the forests to the nomadic South American Indians. The present settlement of the forest regions began only after the arrival there of European colonists who, not finding any more open land, began to clear the forest for settlement; and now some of the originally forested land is more densely populated than the open prairie.

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[57] It is estimated that caingin making has destroyed over half the original forest cover in the Philippines. The abandoned areas quickly become covered with cogon grass and if kept free from fire forest ultimately comes back. J. Paul Goode: The Forests of the Philippines, *Bull. Amer. Geogr. Soc.*, Vol. 44, 1912, pp. 81–89.

[58] The Duke of Mecklenburg: In the Heart of Africa, London, 1910; reference on p. 51. On the deforestation of this portion of Africa see also C. H. Stigand: The Lost Forests of Africa, *Geogr. Journ.*, Vol. 45, 1915, pp. 513–520.

Along the Atlantic shore of Central America the forests began to be cleared for human settlement only after the arrival there of negroes; and on the Island of Formosa clearing took place only through colonization by the Chinese, who, after having cleared the western part of the island, took possession of the entire island and crowded the original population to the eastern part of it.

The earliest settlements in the forest were comparatively small. In Germany the extensive clearings are of a later date than the barbarian invasions, and only the areas which were by nature more or less clear of forest were inhabited in antiquity. Likewise in independent Gaul, especially north of the Loire, cleared and inhabited lands were like small islands encircled by vast forests. A striking example of the island-like character of clearings in the forest may be seen today to the south and southeast of Munich.[59] Such small settlements, when made by a people of comparatively high civilization carrying on agriculture according to improved methods, may last a long time if the extent of the forest territory is very great in comparison with the population. Cultivation on a large scale involving the clearing and agricultural development of enormous areas of land was made possible only in modern times when man became armed with powerful machinery for removing trees and stumps.

THE FOREST AS A SUPPLEMENTARY SOURCE OF FOOD

In the earlier settlements the surrounding forests served as a supplementary source of food for the primitive agriculturist. The cultivation of small parcels of cleared land was supplemented by grazing of stock in the oak or other adjoining forest. The forest also furnished acorns as food for animals and even men, while the wild animals provided meat and hides. During the period of such early agricultural settlements the forest was often protected from destruction because of its value as a hunting ground and as a source of food. There are many evidences of the economic importance of wild edible fruits in the forest in the early settlements of primitive man. In the prehistoric settlements the remains of beech mast have sometimes been found in heaps. Poets and writers of antiquity have preserved the record of the epoch in which the inhabitants of the country surrounding the Mediterranean were fed on acorns and other fruits of the forest. Aside from the Arcadians, called by other Greeks "the acorn eaters," and the statements of Pliny about bread made of acorns, there are many historic evidences of the importance of the acorn in the early economic life of Europe and at a later period. Even today the acorns of various species of oak are an article of food in all the Mediterranean countries. Cultivation of land within the forest, coupled with the gathering of wild fruits, is still going on in many parts of the world, as for instance among the peasants of Siberia and the Indians of North America.

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[59] See Karte des Deutschen Reiches, 1:100,000, sheet 638 (Munich). Reproduced by Jean Brunhes: La géographie humaine, Paris, 1912, p. 97.

As the gathering of wild plants is displaced gradually in the course of economic evolution by the regular production of cultivated crops, stock raising supersedes the hunting of game. As an intermediate stage from hunting to stock raising there is often domestication of animals, as for instance, the breeding of foxes, in a state of semi-domestication, in certain islands of the Bering Sea and in Newfoundland; or the raising of bees in the forest of the Ural Mountains, which is a step in advance of the gathering of wild honey as carried on, for example, by the Veddas but is not rational apiculture with food supplied by properly selected and cultivated crops.[60] In the primitive horticulture of the primeval forest it is customary to cut down the trees in the portion of the forest destined for cultivation, then to burn all the wood or at least the branches and underbrush. The ashes serve as fertilizer; the ground is broken, and the seed, shoots, or tubers are planted. To remove the roots of the trees would be too difficult a task for primitive implements, hence the fields are very imperfect. The peasants of eastern Russia, as well as some agricultural colonists in South America, burn the forest and cultivate the ground for some years, merely to abandon it and repeat the same process every ten or fifteen years. Periodical change of the soil is necessitated by the lack of fertilizer and proper working. It corresponds to the rotation of crops in scientific farming. When one clearing is abandoned, another is opened, and, since the products cannot be abundant owing to inadequate preparation of the soil, the cleared areas are large compared to the small number of people to be supported by them. But such areas are in no sense comparable to those under intensive cultivation. They have the character of oases scattered through the unexplored forest and are exposed to its perils. Wild animals, for instance, may destroy in a few hours the fruits of prolonged toil. The size of the clearing may also depend on the need of the crops for light and space.

Exploitation of Forests the Chief Cause of Their Disappearance

Extensive as this form of agriculture may be, it in itself would not be sufficient to have reduced the forested area of the world to its present size. It is the increased need for the products of the forest itself, particularly its timber, that has made the heaviest inroads upon it. Next to food, wood has been one of the most important factors of civilization, particularly at the time when iron, brick, and other structural materials were either unknown or little used.

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[60] Lorenzi. *op. cit.*, pp. 155, 157.

In the early stages of economic development, the forests furnished man with fuel for overcoming the rigors of winter cold. It furnished fuel also for metal working, and a number of secondary products such as charcoal, pitch, ashes, gallnuts, some of which were more widely used in the past than they are now. In places where intense cold causes a heavy growth of fur on the wild animals, man has made use of materials produced in the forest for tanning the hides, thus providing himself with clothing and with covering for his primitive tents. At a higher stage of civilization and with the development of means of communication and transportation the products of the forest are no longer merely the means with which to satisfy immediate needs; they become commodities of widespread use far beyond the forest boundary. Many industries which were dependent upon wood as fuel found their location in the forest. Thus the occurrence in the same areas of forests and mineral deposits gave rise to metallurgy and the art of glassmaking. In France about the fifteenth century, before the invention of high ovens, metallurgists and glassmakers took up their abode in the forest. In the Middle Ages an entire forest population employed exclusively in industries growing out of the use of wood lived in the forests of France. Kilns, charcoal furnaces, forges, glass furnaces, limekilns, and establishments where wood was worked up gave a peculiar aspect to the forests of that time.

Pallas describes the metallurgic industries connected with the forests of Russia in the Ural Mountains from which the necessary charcoal was obtained. In the forests of Russia also the coexistence of fur-bearing animals and plants producing tanning material has given rise to village industries, chiefly tanning.[61] The forests of the eastern United States were once extensively used for charcoal making in connection with the iron industry.

Rivers as an Aid in Exploitation of the Forests

The penetration of the forests and the development of forest industries have been greatly favored by rivers. Watercourses penetrating forest regions are the natural means of access and with their banks constitute the first zone of attack on the phalanx of the forest. This was the case in Europe; the Rhine and its tributaries formed the principal routes by which extensive openings could be made in the German forests, and in the time of the Romans special corporations transported the felled trees on rafts.[62] The same was true in Italy during the Roman epoch, when the Aniene, the Liri, and the Chiana served as means of transporting wood from the Apennines, and wood from the Alps reached Rome by way of rivers and the ocean.

The vast territory included between Hudson Bay and the Saskatchewan

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[61] Lorenzi, *op. cit.*, pp. 159–162.

[62] L. F. A. Maury: Les forêts de la Gaule et de l'ancienne France, Paris, 1867, p. 79.

River was revealed to missionaries and fur dealers—*voyageurs, coureurs de bois*—by way of the St. Lawrence River. The development of our lumber industry in the early days would not have been so rapid had it not been for the proximity of the New England forests to the coast and the large number of navigable streams, such as the Penobscot, St. John, Androscoggin, St. Croix, and others. Wherever roads are lacking, wherever the rivers are not navigable, the forest cannot serve broad economic ends; in that case the primitive organization remains and the forest furnishes only a local means of livelihood, as is the case in the interior of continents or at high elevations.

In northern Russia forests are still intact because of lack of railways and roads; while the inland location and lack of communication with the coast, together with the long periods during which the rivers are frozen, present obstacles to the development of a wood-exporting industry. Much more favorable are the conditions in the adjoining Scandinavian peninsula, where from the time of the earliest commercial relations with neighboring countries forest products have played a very important part.

The modern development of railroad systems, however, is reducing transportation by water in many regions. Thus in the Vosges Mountains, as well as in our Lake states and Pacific Coast states, transportation by water is dying out altogether.

PSYCHOLOGICAL INFLUENCES

The psychological influence of the forest on primitive peoples has already been noted. At higher stages when man sets himself to overcome the forest he feels its influence none the less surely. Many of the specific pioneer traits of our own original settlers in this country may be traced to their battle against the forest on the slopes of the Alleghanies to provide a place for settlement. The hazardous work of hewing farms out of the virgin forest has bred a race of men of sturdy character and of enormous enterprise and self-reliance. It is true that life in the forest was not conducive to the cultivation of the graces of life characteristic of high culture. The virtues of the backwoodsman were those of a strong animal nature—courage, pertinacity, resourcefulness. In the delightful "Letters from an American Farmer," by J. Hector St. John de Crèvecoeur written in 1783, we find a realistic description of the influence of the forest environment upon the character of the so-called back settlers.

> It is with men as it is with the plants and animals that grow and live in the forests; they are entirely different from those that live in the plains. . . . By living in or near the woods their actions are regulated by the wildness of the neighborhood. The deer often came to eat their grain, the wolves to destroy their sheep, the bears to kill their hogs, the foxes to catch their poultry. This surrounding hostility immediately puts the gun into their hands; they watch these animals, they kill some . . . they soon become professed hunters. . . . The chase renders them ferocious, gloomy, and unsociable.[63]

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[63] Everyman's Library edit., pp. 51–52.

In spite, however, of coarseness and even brutality, these people were undeniably men. No weaklings were produced by the life of the forest. The boundless woods with the long stretches of swamp land, the rough trails, the isolated homesteads sometimes miles away from the nearest neighbor bred unwillingness to co-operate with others for common purposes or to submit to any kind of discipline.

During the slow process of hewing their farms out of the forest the settlers were compelled to rely for many necessities on their own skill with the ax. From the forest they obtained all the material for the construction of their cabins from the puncheon floor to the shingles of the roof and the moss that calked the crevices of the walls. All these, together with the rude furniture, they got from the trees on their homesteads. The forest also supplied them with meat to vary the monotony of salt pork, itself made from hogs that found every bit of nutriment in the spontaneous products of the forests.

The back settlers, however, in the course of time lost much of their coarseness and produced leaders such as Henry Clay, Jackson, Benton, Cass, and scores of others, who for over half a century helped to shape the destiny of their country. In Abraham Lincoln this type of leader, purged of all the repulsive characteristics of the early type, found its highest expression. The old characteristics of the back settlers disappeared in him and "nothing remained but the pure metal—strong, keen, tempered to perfection, and yet at other times as soft and pliable as gold without alloy." [64]

The entire ancient history of Sweden may also be reduced to the same struggle with the primeval forest. It is the colonization of the forests of northern Russia that has developed in the Russian people the necessary qualities which enabled them to spread to Siberia and take possession of it.

If of all the present nations the Anglo-Saxons, the Teutons, and the Russians display the great colonizing capacity, may it not be attributed largely to their original impenetrable forests, in the struggle with which they have developed the persistence and unrelenting energy required for pioneer work?

Deforestation and the Progress of Civilization

With the growth of population and the spread of civilization the world's forested area has been progressively reduced. At present there is still under forest about five billion acres; if the brush land is included, considerably more, probably one-fourth of the entire land area. About another fourth of the land surface is covered with desert and tundra, which must be excluded from the possible area of human habitation. Therefore the land area available for human activities is none too large. If we compare the relative amount of the land under forest in the different regions of Europe which have comparable climatic and other conditions for timber growth, we find that

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[64] Ernest Bruncken: North American Forests and Forestry: Their Relations to the National Life of the American People, New York, 1899, p. 46.

England has only 4 per cent of its land in forest; France, 18 per cent; Belgium, 17 per cent; Germany, 26 per cent; Austria, 30 per cent; Russia, 32 per cent; Sweden, 40 per cent; and Finland, 60 per cent. These figures express also, although in inverse ratio, the relative density of population in these countries. In these figures as in a mirror, is reflected the progressive movement of human civilization.

Other factors may undoubtedly act as a modifying influence. Legal protection of woodlands may have had some effect in preventing indiscriminate deforestation as agriculture, commerce, and industries have developed; but in a broad way the extent to which the forest is cleared is in direct relation to the density of population and therefore to the conditions of civilization.

While it would be misleading to lay down, as a general law, without any qualification, that the decrease in forested area and human progress always go hand in hand, it is nevertheless true that up to the present time the countries having the most highly developed economic organization have also a greater population and a proportionately reduced forest area. This was true in ancient times as it is true now. Thus, for instance, the deforestation of ancient Greece at its highest period of development had progressed much farther than that of the southern end of the Apennine peninsula—at that time in a lower stage of development. The Hellenes then looked upon Italy as a densely forested country. Thus Alcibiades, exiled from Athens, in the discourse delivered to the Lacedaemonians, urging them to aid Syracuse, which was menaced by the Athenians, advised: "build many triremes in addition to those we have, for Italy has wood in great abundance."

Reforestation Following Decline of Civilization

As the progress of ancient civilization, of which agriculture was an essential part, tended to the destruction of the primeval forests, so conversely, with the passing of this civilization, with the decadence of empire and the return to barbarism, the forests, aided by pestilence and devastating wars, gradually restored themselves. In a most striking description of the devastation of Italy Lucan states that brambles and trees spread over untilled ground at the time of the Antonines. After Venice was invaded by the Marcomanni and after the spread of pestilence accompanied by floods, earthquakes, and swarms of locusts, the population of Italy was greatly decreased, and the forests spread over the abandoned territory. In Roman Italy in the time of Augustus, according to the most probable estimates, the population numbered about 6,000,000, and the area of land under agriculture, which was a combination of field crops with pasture in oak forests, was comparatively large. As this area gradually decreased, the forests, no longer checked by the ax and the depredations of grazing animals, spread again over the natural domain which had been taken from them for agricultural purposes. In the great crisis of the third century desolating wars further aggravated the conditions. Lactantius, speaking of the exorbitant taxes levied by Diocletian, mentions that the colonists abandoned their fields and that the fields then became covered with forests. Incursions of the forest upon cultivated fields reached to the very walls of the cities and even to the centers of inhabited places.[65]

In his history of the forests of France Maury mentions ruins dug up in the dense forests of the eastern region, and on the top of a ridge near Orleans was found in the midst of a forest a Roman *castrum* destroyed by the Vandals. In the Government of Smolensk in Russia fields and towns abandoned in 1812 as a result of the Napoleonic invasion, and later during the famine of 1840 to 1850, were very soon overgrown by forests. Similar cases are found throughout the United States from Virginia to Florida, where forests sprang up on fields abandoned after the Civil War. Even in New England with the migration of the population westward many abandoned fields have come back to forest and today are being cut over for the second and third times. If the climate is favorable and there is no interference from man a few decades are sufficient for fields to become changed into dense forests.[66]

THE STRUGGLE BETWEEN MAN AND FOREST

Cook in speaking of the effect of agriculture on natural vegetation in Central America says:

> Many localities which are now occupied by apparently virgin forests are shown by archeological remains to be regions of reforestation. Thus in the Senahu-Cahabón district of Alta Vera Paz relics of two or three very different types of primitive civilization indicate that as many ancient populations have occupied successively the same areas which are now being cleared anew by the coffee planters as though for the first time.
>
> It does not yet appear that any considerable region of forest has been explored in Central America without finding similar evidence that the present forests are not truly virgin growth.[67]

And again, speaking of the evidence of antiquity as exemplified by the crumbling of large earthenware pots of an earlier civilization, he continues:

> We cannot know how long it has taken the pottery to crumble, but we can at least contrast the condition of these decayed pots with other pieces of pottery placed in caves of the same district in later prehistoric ages, which still appear fresh and new, as though recently burned. And yet the bones beside these apparently new pots have also crumbled nearly to dust, and there has been time for the surrounding country to be occupied with old forests of hardwood trees, like true virgin growth.

He also mentions terracing of the land as showing that agriculture was formerly extensively practiced and notes the presence of a type of terrace evidently designed "to hold drainage water and prevent erosion . . . . .

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[65] Lorenzi, *op. cit.*, pp. 48, 49.

[66] *Ibid.*

[67] O. F. Cook: Vegetation Affected by Agriculture in Central America, *Bur. of Plant Industry Bull. No. 145*, p. 16, U. S. Dept. of Agric., Washington, D. C., 1909.

[being] frequently met with in the heavily forested region in eastern Guatemala." [68]

What is regarded by some geographers as evidence of a civilization that had arisen in the primeval forest is nothing but the remains of a civilization which succeeded in clearing the forest; with the decline of this civilization and favored by a warm and moist climate, the forest again took possession of the land.

In regions, however, where the climate is unfavorable or where there is even slight interference on the part of man the return of the forest is slow, the land is either merely run over with brambles and vines or becomes virtually a desert. Thus in the region of Friuli there are ruins of medieval castles destroyed during the last years of the Venetian Republic but not yet overrun by forest vegetation except ivy. Bishop Ennodio relates that the fields of Italy at the time of the wars between Theodoric and Odoacer were stripped of their indigenous covering and were overgrown with thorny plants. In many uncultivated areas which served as pasture during the last centuries of the empire the growth of forests was retarded, if not checked altogether, because pasturage on a large scale, as carried on in many parts of Italy, made it impossible for the forest to re-establish itself. The forests of beech and oak which probably covered the land about Rome in early historical times never returned.[69]

THE ORIGINAL COMPOSITION OF THE FOREST CHANGED BY MAN

There is another important influence which man has exerted upon the forest. The colonization of forest regions not only reduces the forest area but radically changes the entire structure and composition of the remaining forest. In analyzing the names of places, towns, and cities which are made up of words designating forest trees of one kind or another, one is at once impressed by the large number made up of the names of hardwood trees and the very small number designating pines, spruces, or even fir.[70] Of the geographic names of central Europe which indicate the origin of the settlements in forested regions, nearly 90 per cent point to the existence of broad-leaved forests. One can find any number of names indicating an origin in a locality where linden was prevalent: Lindewiese, Lindenfels, Lindenau, Linden, Lindenhoff. With oak there is even a larger number, of which it is enough to mention: Eichendorf, Eichorst, Eichrodt, Eichenfeld, Eichstat, Eichwald. Birch also takes a prominent part in giving names to many places; as, for instance, Birkenfeld, Birkenhain. Beech is also prominently represented, such names as Buchholz and Buchhorn being very numerous. Ash also contributed to the names of many towns; as, for instance, Eschenbach, Eschweiler. Even alder enters into the formation of geographic names, as, for instance, Erlau. One looks almost in vain, however, for towns or places whose names signify pine or spruce. Once in a while one finds such a name as Tannhausen.[71]

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[68] Cook, *op. cit.*, p. 17.

[69] Lorenzi, *op. cit.*

[70] Richard Marek: Zur Anthropogeographie des Waldes, *Geogr. Zeitschr.*, Vol. 18, 1912, pp. 1–15.

From this it is natural to infer that in the past the conifers had not the same wide distribution that they now have. As far as Germany is concerned, the preponderance of coniferous over broad-leaved trees has undoubtedly been brought about artificially by planting pine and spruce as the most profitable species. It is also possible that the land first cleared was that occupied by broad-leaved forests because of the more fertile soil naturally found under such growth, while the poorer sandy soils occupied by the conifers remained uncleared and unsettled. In Michigan the repeated fires have undoubtedly helped the spread of jack pine and Norway pine at the expense of the hardwoods, just as in the South the scrub pine, loblolly pine, and the slash pine extended their range at the expense of other species also as a result of fires accompanying settlement. In the central Rockies fire has changed many a Douglas fir stand into a lodgepole pine forest. This change in the composition of the original forest is evidenced throughout the entire world. Thus in Sweden, pine successfully competes with fir only in the presence of frequent fires, since on burns it comes up and grows faster than fir. In Europe it is an interesting fact that the pine extends its range parallel with the advance of towns and villages.

Civilization Dominating Forests

Over a large part of the world the forest is now conquered. It is not only conquered, it is exterminated beyond any possible chance of natural recovery. It has now become important to civilization to preserve and restore the forest instead of struggling against it. Out of a land area of some 32½ billion acres there is little more than 5 billion acres remaining in forest—exclusive of brush land—or only one-sixth of the land area. The greatest change of course has taken place in Europe, where of a total land area of nearly 2½ billion acres there remain now barely 750 million acres in forest. Even of this, two-thirds are found in European Russia and Finland and about 250 million acres in the rest of Europe. In some countries—Great Britain, for instance—nearly 95 per cent of all the original forest is gone. In France, Spain, Belgium, Rumania, and Greece, from 80 to 90 per cent of the original forest has been destroyed; in Bulgaria, Serbia, and European Russia exclusive of Finland, from 60 to 70 per cent; and in North America the original forest has shrunk from some 822 million acres to 463 million acres in the course of three centuries.

THE INCREASING NEED OF WOOD

The disappearance of the forest, however, has not done away with the use of wood by the present civilization; on the contrary it has only intensified it. Although steel, brick, and concrete are now more and more taking the place of wood for structural purposes, industries are arising every day which are dependent upon wood as raw material. As a striking illustration may be mentioned the pulpwood industry which within a few decades has assumed enormous proportions. In 1880 the consumption of pulpwood in our own country was barely 300,000 cords; twenty years later the consumption had grown to 2,000,000 cords; in ten years more this had more than doubled, and at present it has grown to around 6,000,000 cords. In Great Britain the total consumption of lumber during the period 1851–1911 increased fivefold, and the per capita consumption has also steadily increased, being in 1911 more than three times what it was 60 years before. In spite of the fact that production from German forests has doubled in volume within the past century, the imports from other countries have steadily increased in amount. While there are factors, such as the preservative treatment of wood and the substitution of other materials for construction purposes, which may tend to check the consumption of timber, it is a feature of modern commercial progress that, in spite of this, consumption per capita is steadily increasing.

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[71] The situation is similar in Britain. See Kate Qualtrough: Mythology and Mankind, *Journ. Manchester Geogr. Soc.*, Vol. 34, 1918, pp. 31–50; reference on p. 35.

Not only are the densely populated countries of Europe making heavy importations of lumber and other forest products. In our own country large sections like the Northeast and the Lake states, which not long ago had enormous forest areas and supplied the needs not only of the entire country but of other countries, are dependent upon wood from other regions, such as the Southeastern Pine Belt and the Pacific coast. This wood has to be brought from distances even greater than those over which some of the European countries are now importing. Backward countries in various parts of the world are now being called upon more and more to meet the growing deficit of wood in the world. Armed with powerful logging machinery and highly developed means of transportation the timber trader invades the remaining primeval forests and re-enacts there the same process which the European countries had gone through centuries ago—only at a more accelerated rate.

Social and Economic Evils of Forest Devastation

The clearing of the forest, aside from depriving the thickly settled and highly civilized countries of timber needed for their industries, has produced other bad economic and social effects.[72] The stripping of the mountain forests resulted in the occurrence of torrents, in erosion, in floods, and in a general change in the régime of streams. The disappearance of the forest has also affected the climate and with the growth of industrialism has resulted in the physical deterioration of a large part of the population. Much of the forest land that has been cleared on mountain slopes, sandy plains, or rocky hills has proved unsuitable for agriculture and has failed to provide room for permanent settlement. Just as in the past the primeval forests proved a barrier to human settlement, today it is the vast stretches of cut-over and burned-over forest lands, unsuited to agriculture which are an economic barrier to permanent settlement in many parts of the United States, Canada, and other new countries. In the United States alone there are over 80,000,000 acres of such idle waste land. The soil too poor to maintain purely agricultural communities and the lumber industry gone with the disappearance of the forest and therefore no longer a source of livelihood to the local population—there is nothing left to keep the settler on the land. The dreary wastes, dismantled sawmills, deserted towns, so common throughout the Lake states, Pennsylvania, and other sections of the East, are depressing reminders of the day when these regions were the centers of lumber production for the entire country and sustained prosperous communities.

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[72] The case has been well put by S. T. Dana: Forestry and Community Development, *U. S. Dept. of Agric. Bull. No. 638* (contribution from the Forest Service), Washington, D. C., 1918, abstracted in the *Geogr. Rev.* Vol. 5, 1918, pp. 497–498.

The products of the forest have now become altogether too valuable and no civilized nation can afford forest devastation on a large scale without regard to the future possibilities of the land. The demand for forest products is now so great that the cutting away of the forest, even on fairly good agricultural land, is far in advance of the possibility of actual land settlement. If the cutting is not followed by another forest growth or the land is not taken up by settlers for cultivation, the result is an economic waste and reduced production of the primary necessities of life.

Practically all of the civilized countries of the world have now come to realize that there is a point beyond which further clearing of the forest, no matter what the density of the population may be, proves detrimental to progress itself. Europe reached that point several centuries ago.

In central Europe the period of the greatest clearing of forest land for settlement was practically completed by the end of the thirteenth century, although considerable clearing has taken place since then in the more remote districts and particularly in the Alps. In the Canton of Zurich it is very definitely established that for the last 250 years the forest area has been reduced only 2.85 per cent. Better agricultural methods which made it possible to produce larger crops on smaller areas and the apparent evils resulting from the destruction of forests on mountain slopes led to adoption of legislative measures for the purpose of checking further clearing of forest on non-agricultural land.

The lesson of the older countries found a reaction also in countries still having abundant forests. In practically the entire civilized world a new economic force has now been born—a general appreciation of the value of forests and a movement toward the introduction of rational forest management. There is no doubt whatever that in civilized countries there is enough accessible actual and potential forest land not suitable for agriculture to produce under proper management timber enough to supply indefinitely the world's great demand.

The New Movement Toward Rational Management

Nearly every civilized country at the present time has adopted or is considering measures for the perpetuation of the existing forests, or even for extending their present area. Thus England which, because of her insular position and proximity to countries still possessing vast forest areas and because of her cheap water transportation, could best of all get along with a small forest area has now, as a result of bitter experience during the war, worked out a plan for planting some 1,700,000 acres and providing a forest area sufficient to sustain her domestic needs in case of emergency for three years. France, which for over a century has been carefully husbanding her forests, is further elaborating plans for their careful management and is enlarging her forest nurseries for extensive planting. Germany, Switzerland, Italy, Norway, Sweden, and New Zealand are also considering means of increasing forest products. Even in our own country the maintenance and protection of existing forests has become a pressing question of the day.

Nearly all of the forests now found in western Europe are man-made. With increase in population more intensive use of all resources became necessary, especially of those resources which through more intensive application of labor, knowledge, and skill could be made to produce more fully. Forests being a poor-land crop prove more profitable than agricultural crops on non-agricultural lands. The day of the forester—the timber farmer—has now arrived in practically all densely populated countries of the world, and his work is to secure forest crops by human skill just as food crops are now being secured. Nor is the less material rôle of the forest being overlooked. In order to offset deterioration in the physical and ethical well-being of the people crowded in industrial centers with poor housing facilities, state and municipal forests are being established as a source of healthy recreation for the densely populated countries of Europe.

The new forest may be different from the original forest which once occupied the ground. It certainly bears a more utilitarian aspect. The trees that are being grown are not always of the kind that nature would prefer to produce under given conditions of climate and soil, but are those which man needs most. Just as intensive farming has increased the production of the land, so the forester is now producing five to ten times as much useful material as nature unaided produced before. Although the man-made forest may not have the beauty and grandeur of the wild woods which were the result of the free play of natural forces, it has a new beauty—the beauty of orderliness and usefulness. It is no less an important factor in civilization from the ethical and geographical point of view, because at present the economic principle is applied to it, as it is now being applied to the raising of agricultural crops.[73]

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[73] B. E. Fernow: The Relation of Forests to our Civilization, *Journ. of Agriculture*, Univ. of California, Vol. 4, 1916, p. 76.

THE REGION OF MAXIMUM INACCESSIBILITY IN THE ARCTIC

By Vilhjalmur Stefansson

Most people imagine that the degree of inaccessibility of polar regions depends mainly on latitude. This is not true, nor is the problem so simple that it can be stated briefly. Neither are the facts sufficiently known as yet for a final and correct answer. But we do understand many of the conditions that modify the problem and an approximate statement of them is possible.

The main condition that determines the comparative accessibility of points within the polar regions is the configuration of the lands and their effect upon the ocean currents. The great oceans, the Atlantic and the Pacific, are similar in that each has its own warm current, but they differ fundamentally in this: that the Japan Current of the Pacific is effectually shut out from the Arctic on that side by the chain of the Aleutian Islands, so that instead of flowing north into the polar sea to melt away the ice, it expends its heat chiefly along the coast of southern Alaska and the western coast of Canada and the United States, profoundly modifying the climate of those regions. But in the Atlantic the Gulf Stream flows unhindered northward through the wide and deep gap between Norway and Greenland, splitting on Iceland and giving it a climate approximating that of Scotland. We may truthfully think of the Gulf Stream as melting away the polar ice (which otherwise would come down to the northern coast of Iceland) with such effect that ships can sail ten or eleven degrees (or seven hundred miles) farther north on the Atlantic side than they can on the Pacific side of the Arctic.

Two Stages of Approach

Up to the present, polar exploration has been conducted in two stages. First, men sail towards the unexplored area as far as they can go in ships. From this point they travel with sledges hauled by dogs or men and in some cases by both.

In connection with this article I have prepared a map showing graphically, although with only approximate correctness, the comparative accessibility of various points within the arctic regions. The most northerly points known to have been attained by ships under sail or steam have been plotted on this map, and lines have been drawn connecting these points. It is possible that in certain places a ship could sail a little farther north; but no ship has as yet done so, and in general we may consider this the area "inaccessible to ships."

Beyond the farthest points yet attained by ships the exploration of the polar regions has been carried on mainly by men or dogs drawing sledges loaded with supplies upon which both men and dogs depended for subsistence. In some cases the length of the journey has been somewhat extended by the killing of the dogs originally used as draft animals and the conversion of their flesh to use as food either for the remaining dogs or for the men.

The "Pole of Inaccessibility"

It will be generally conceded that the best journey so far made by this method was that of Admiral Peary from Cape Columbia to the Pole. This is a linear distance of about 500 geographical miles. To show graphically some of the points that by this method have an inaccessibility comparable to that of the Pole itself, a distance of 500 miles has been allowed for along the meridians on which Nansen, DeLong, Collinson, and others attained their farthest north by ship, either under steam or sail. These positions are marked on the map by dots enclosed in small circles. From the dots have been drawn arcs of circles of 500-mile radius. The intersecting arcs delimit the inner border of a zone of "comparative accessibility" considered from the point of view of a system of exploration similar to Peary's. The area enclosed by the intersecting arcs—stippled on the map—is the area of "comparative inaccessibility." Any point within it is less accessible than the North Pole. The average rate of Peary's travel was about 12 miles a day, so that in five days a distance of sixty miles was covered. Isochronic lines representing this distance have been drawn within the area of comparative inaccessibility. The center—determined by the intersection of arcs with centers at the ships' positions of Peary, Berry, and Nansen—is the "Pole of Inaccessibility." It is the point within the arctic regions most difficult of access for any explorer who first goes as far as he can by ship and then pushes forward by the use of men and dogs hauling sledges.

When the time of exploration by airplanes or dirigibles shall come, this map will still express roughly the comparative inaccessibility of various points within the polar regions, for the presumption is that such flights would be made from bases established by ships under steam. Of course, it will eventually become possible to fly direct from any such city as New York or London to any point within the northern hemisphere, and for such undertakings this map will have no significance.

Factors Modifying the Theoretical Results

Should anyone desire to use this map as the basis either for the planning of an actual polar expedition or for the illustration of theories upon the subject, he will have to bear in mind various modifying factors, the most important of which are the following:

1. When traveling over the surface of the mobile north-polar ice the first difficulty is with currents. For instance, it is possible to sail comparatively near the North Pole in the longitude of Spitsbergen; but Parry and most of his followers found that when they strove to march north in this region their

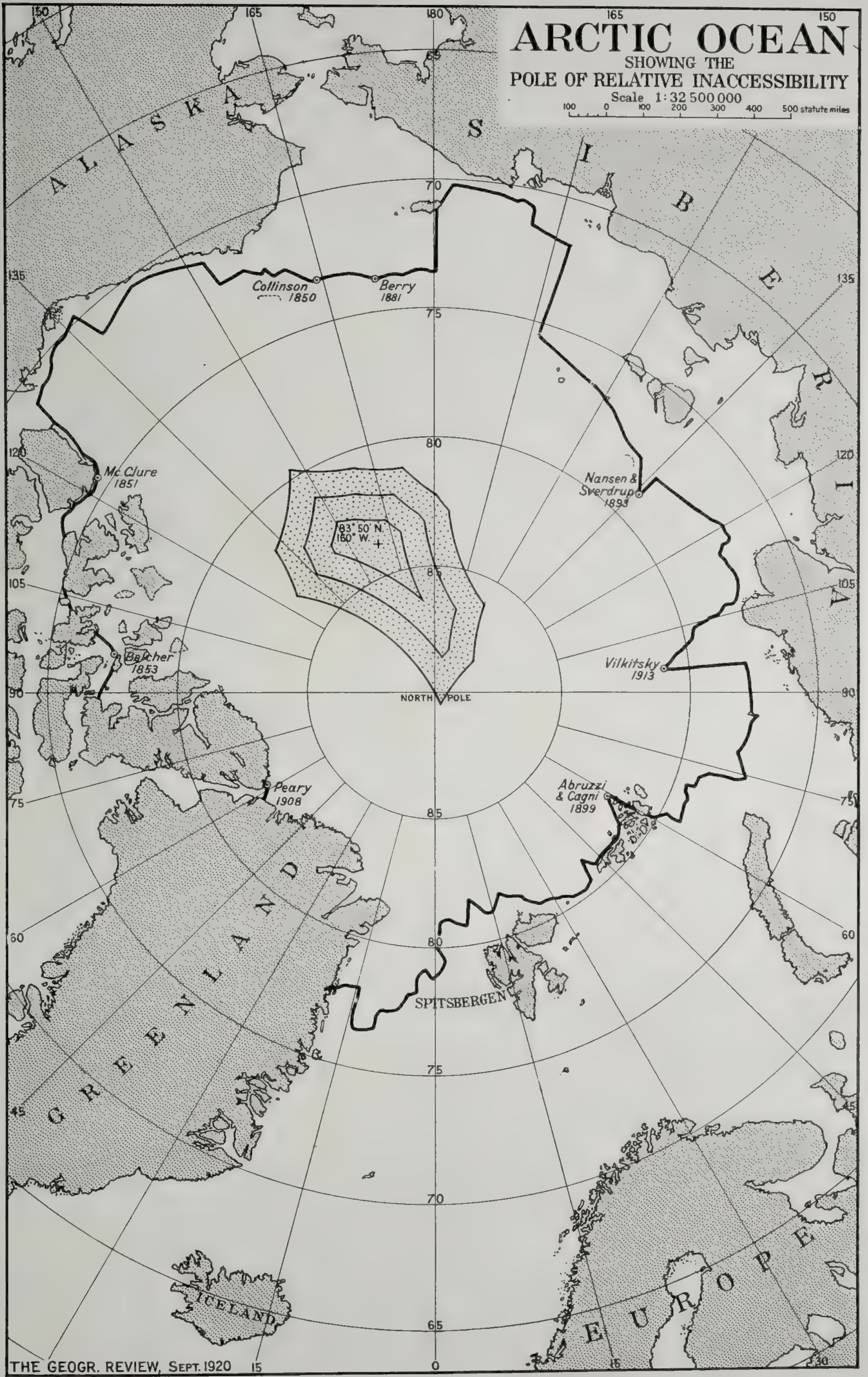

FIG. 1—The entire area outside of the heavy solid line may be called the "Zone of Approach by Ship;" the area within it the "Zone of Man-and-Dog Travel." The stippled portion of the latter is the "Zone of Comparative Inaccessibility." The distance between the isochronic lines is five days dog-sledge travel or 60 miles. Incidentally the map shows the superiority of Peary's position of 1908 over all others on land as a base for a dash aimed at the point of latitude 90° N. It is also favorably situated for an attack on the "Pole of Inaccessibility," which is only 200 miles farther away from Peary's base than the North Pole.

efforts were in part cancelled by the continuous southward drift of the ice over which they were traveling. Our own work has shown that a similar southward drift, although perhaps not so strong a one, would have to be faced by anyone traveling north near the 138th meridian W. To the north of Grant Land Peary found an eastward drift though it did not handicap him materially. It is probable, on the other hand, that anyone starting north from Wrangell Island or the New Siberia Islands would get considerable help from a current running partly in his favor.

2. At times an even more serious handicap than an adverse current is the frequency of open leads. Judging from the narratives of polar explorers, this particular handicap is most serious in the region north of eastern Siberia, where Baron Wrangell traveled a century ago, and in the belt of generally similar conditions north of Alaska with which I have personal acquaintance. This handicap is of little weight northwest of Prince Patrick Island, as I have found by experience, and northwest of Cape Thomas Hubbard and north of Cape Columbia, as shown by the narratives of Peary and MacMillan.

3. In regions where currents are violent the ice is broken up with a resulting formation not only of the leads of open water which we have considered, but the heavy pressure ridges which make sledge travel more arduous and occasionally compel actual road making with pickaxes. The trouble with pressure ridges is generally greatest near land and becomes less and less as one goes farther from shore. They are the more troublesome the younger the ice. It seems now fairly clear that much of the polar ice is formed originally on the American and Siberian side of the Arctic and drifts across past the northern end of Greenland towards Franz Josef Land where it vanishes in the Gulf Stream.

This is one of the many reasons which made Peary's "American route to the Pole" the most desirable. Not only could he sail farther north by ship and then have comparatively few leads to contend with, but he had the added advantage of traveling in considerable part over ice which had been formed many years earlier, perhaps in the Beaufort Sea, and had been drifting towards Greenland and gradually thickening season by season until it was comparatively smooth and stable.

4. We have now considered the main points which must be kept in mind in interpreting the rather rigid data of the map. There remains a matter which was of little consequence to Wrangell, Nansen, or Peary. In their work they counted little upon replenishing their stock of food and fuel and thus making their journeys longer and easier through the killing of local animals, such as seals, polar bear, or fish. The presence of these, except near land, was either unsuspected or ignored; it formed no basis of their calculation and did not in practice affect their results materially. But in the system of "living off the country"[1] the animal life of the region is vitally important.

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[1] Vilhjalmur Stefansson: "Living Off the Country" as a Method of Arctic Exploration, *Geogr. Rev.*, Vol. 7 1919, pp. 291–310.

THE QUESTION OF FOOD SUPPLY

From my study of north polar conditions I conclude that the amount of animal life has no direct relation to latitude. We have already seen that the North Pole by no means corresponds to the Pole of Inaccessibility which is distant from it by more than 400 miles. The North Pole lies, therefore, towards the edge of the area that is difficult of access through being covered with floating ice. It might seem more reasonable to suppose, then, that the amount of animal life would vary with distance from the Pole of Inaccessibility, but that does not seem to be the case either.

In the present discussion we shall ignore all forms of life except the seal, for this is the only animal upon which it appears practical to rely. We have seen whales and fish as far from land as we have seen seals, but in planning a journey over the ice I think it unlikely that I should ever trouble enough about animals other than the seal to carry equipment for securing them. It is probable that seals have no great difficulty anywhere within the polar area in securing food and that the most serious condition they have to fight is the massing of the ice in such a way that they cannot come up to breathe. In the summer it can be assumed that most of the seals are in open water; that is, they are either living in neighborhoods where there are scattered ice cakes like islands in a sea of water or else where there are open leads running like great rivers across the ice fields. In autumn the water of the leads will freeze over, at first with a thin ice that can be easily broken; but when this ice gets to be four inches or more in thickness the seal has to keep open a breathing hole by gnawing. Seals that live in comparatively level bay ice near land (and the same is doubtless true of seals living under level patches of ice on the ocean) have commonly several breathing holes, perhaps half a dozen or more, scattered over two or three acres of area. These holes are of necessity cigar-shaped, so as to admit the body of the seal when the ice gets several feet thick. The actual breathing hole to the surface is the size of the mouth of a water tumbler, or even smaller, and may be covered with snow. Presumably the seal, in looking up when swimming about in the water, can see light patches where his breathing holes are, and thus he is enabled to find them again after having descended to feed. He does not have to go deep to feed, for he lives mainly on the floating animal life near the surface rather than on fishes, although he gets a few of these also. He is stationary with reference to his breathing holes but continually moving with reference to the sea bottom and traveling in the same direction as the ice under which he lives.

It has been understood now for decades that a ship that freezes in the ice near Wrangell Island or the New Siberia Islands will arrive three or four years later in the ocean north of the Atlantic. Similarly, a seal that finds himself in the vicinity of Wrangell Island in the fall of a certain year will, in all probability, find himself two or three years later in the vicinity of Spitsbergen. Assuming that the ice that drifts across the Pole of Inaccessibility, or the North Pole for that matter, was originally formed in the Beaufort Sea where seals are known to be abundant, it will follow that a certain number of seals are continually being carried across either Pole.

"ICE DESERTS"

But there are undoubtedly in the Arctic certain "ice deserts." These are regions similar to the Sargasso Sea. In them pressure due to winds or currents operating from a distance heaps the ice up, and it may even remain in an eddy for years. We found one such region north of Prince Patrick Island. Seals were not absent but they were comparatively rare, and they became more numerous again when we got farther north. On coming to such an ice desert the traveler who depends on some method similar to ours, where the main reliance for food and fuel is upon seals, will find that he is face to face with a problem similar to that of a traveler who, in crossing an unknown continent in tropical or temperate regions, finds himself gradually entering a desert produced by lack of rain. Such a traveler overland would have to depend upon his judgment. He might avoid the desert by skirting it; he might turn back, giving up his journey for the time being; or he might make a dash across, hoping that his resources would take him to the farther side of the hostile area. Just such a problem one would have to face in ice travel on coming to a region where an eddy existed and where massed ice had evidently persisted for years.

That is, it would be a problem to a party trying to live by forage. To a company using the Peary pemmican-and-relay system it would constitute no problem at all. They would care about the smoothness, stability, freedom from leads of the ice, and under these heads they might find the conditions excellent—they probably would. For the presence or absence of seals beneath their feet they would care not at all.

But for those who count on getting their food and fuel as they go, these ice deserts are the one source of gravest concern. We cannot tell in advance for certain where we shall find them, for we can reason only on the basis of what we know and in the Arctic there are still many things unknown. When we come to the edge of such deserts we can guess only very roughly at their extent or in what direction the diameter will be least. They are, in the system of "living by forage," the most serious source of danger, although the mere understanding of their existence lessens the danger.

NEW MONTHLY AND SEASONAL RAINFALL MAPS OF THE UNITED STATES*

By Robert DeC. Ward

Harvard University

Introduction

In studying any series of monthly and seasonal rainfall maps, it is important to remember that no single chart represents a fixed condition. Each shows a transitional stage between the rainfall of the preceding and that of the following map. The most vivid, as well as the most accurate, conception of the distribution of the rainfall throughout the year is gained by viewing the successive maps as if they were a set of stereopticon pictures. Each picture develops out of the preceding one and dissolves into that which follows. The best way to gain this view is to hang the whole series of maps on a rack, or, if the maps are of small size, to have them all printed or mounted on one sheet. Each chart should then be thought of as a "snapshot" of constantly fluctuating conditions.

It is by no means difficult to familiarize oneself with the essential characteristics of each month's rainfall. The outstanding features may easily be remembered if the types and the chief controls of rainfall are held in mind. Indeed, it almost immediately becomes possible to name the month or season whose rainfall is shown on any chart, although the designation of the map be concealed. This method of study has been successfully used for the past twenty-five years in the writer's course of lectures and laboratory work on the climatology of the United States. For ordinary purposes, in any general study of climatology, only the more important features of the seasonal and monthly rainfalls need consideration. Details as to the actual amounts of rainfall are difficult to remember. A discussion of them is out of place here. Furthermore, such details may readily be secured, when needed, from the official publications of the Weather Bureau.

In a general survey of rainfall distribution throughout the year the seasonal maps may best be taken as the basis of study. They show the larger facts. They cover divisions of the year which are universally recognized as logical and as having human and economic significance. Further, they sufficiently emphasize the essential characteristics of the varying rainfall in different parts of the year without the risk of the confusion which is not unlikely to result from a detailed study of the twelve monthly maps. The latter should, however, by no means be discarded.

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* This is the sixth in a series of articles by the present writer on the climatology of the United States. The previous articles were: Climatic Subdivisions of the United States, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 672–680; Rainfall Types of the United States, *Geogr. Rev.*, Vol. 4, 1917, pp. 131–144; Rainy Days and Rain Probability in the United States, *Geogr. Rev.*, Vol. 7, 1919, pp. 44–48; Frost in the United States [a review], *Geogr. Rev.*, Vol. 7, 1919, pp. 339–344; Cloudiness in the United States, *Geogr. Rev.*, Vol. 9, 1920, pp. 347–356.

THE NEW CHARTS

Several sets of monthly and seasonal rainfall maps of the United States have been published.[1] There are certain fundamental objections to them. (1) The number of stations for which data were available was limited. (2) The records did not cover a uniform period and were not reduced to a uniform period. (3) The isohyetal lines were generally drawn with little or no regard to topographic controls. For the climatic section of the "Atlas of American Agriculture" there has recently been prepared a new and very complete series of rainfall charts. The precipitation section of the "Atlas" has not yet been published. In view of a long delay in the issue of the "Atlas," and of the fact that, when it appears, it will not be available for general distribution because of the limited edition necessitated by the high cost of printing, advance publication of several of the new charts has been thought advisable. Thus, the new chart of mean annual precipitation was issued, as a separate "advance" sheet, in January, 1917, and was later also included in the *Monthly Weather Review* for July, 1917.[2]

More recently, the full set of new monthly and seasonal charts, later to appear in the "Atlas," has been published, in the *Monthly Weather Review*

Lorin Blodget: Climatology of the United States and of the Temperate Latitudes of the North American Continent. 536 pp.; maps, diagrs. Philadelphia, 1857. [Rainfall maps for the year and the seasons.]

[1] C. A. Schott: Tables and Results of the Precipitation, in Rain and Snow, in the United States; and at Some Stations in Adjacent Parts of North America, and in Central and South America. *Smithsonian Contributions to Knowledge, No. 222*, Vol. 18, pp. 1–175; maps, diagrs. Washington, D. C., 1872. [Rainfall maps for summer, winter, and year.]

Idem: 2nd edit. *Smithsonian Contributions to Knowledge, No. 353*, Vol. 24, pp. i–xx and 1–249; maps, diagrs. Washington, D. C., 1885. [Charts for year and for four seasons.]

H. H. C. Dunwoody: Charts and Tables Showing Geographical Distribution of Rainfall in the United States. 51 pp.; maps. *U. S. Signal Service Professional Paper No. 9.* Washington, D. C., 1883. [Monthly and annual charts.]

Idem: Normal Monthly Rainfall throughout the United States, Based upon 18-Year Normals, Accompanied by a General Description of the Rainfall of the United States. 10 pp.; maps. U. S. Signal Service, Washington, D. C., 1889.

A. W. Greely: American Weather. 286 pp.; maps. New York, 1888. [Charts XIII–XV, average rainfall for April, May, and June, based on 18 years' observations.]

M. W. Harrington: Rainfall and Snow of the United States, Compiled to the End of 1891, with Annual Seasonal, Monthly, and Other Charts. *Weather Bur. Bull. C.* Washington, D. C., 1894. Atlas and Text. [The monthly maps are reproduced, on a small scale, in "Atlas of Meteorology," 1899, Pl. 24; text, pp. 24–25. The isohyetal lines have been extended into Canada and Mexico.]

A. J. Henry: Rainfall of the United States, with Annual, Seasonal, and Other Charts. *Weather Bur. Bull. D.* Washington, D. C., 1897. [Charts of mean annual rainfall for the United States as a whole, and for the eastern United States for April–September.]

See also B. C. Wallis: The Rainfall of the Northeastern United States; *idem*, The Distribution of the Rainfall in the Eastern United States; *idem*, The Distribution of the Rainfall in the Western United States; *idem*, The Rainfall Régime of the Several States, *Monthly Weather Rev.*, Vol. 43, 1915, pp. 11–14, 14–24, 170–175, 176–178. [In this series of papers the author presents charts showing the rainfalls for each month by lines of equal departure from the rainfall norm, or "equipluves." The norm is the amount of rainfall that would occur at any place on the assumption that such rainfall is evenly distributed throughout the year. In other words, the usual *monthly* rainfall averages are expressed as percentages of the *annual* value at each station. Charts of the wettest and driest months, and of rainfall regions, are given, as well as diagrams of rainfall intensities.]

Idem: Rainfall and Raininess, *ibid.*, Vol. 46, 1918, pp. 229–230. [Gives diagrams showing how to convert "equipluves" into isohyets, *i.e.* raininess into rainfall and *vice versa*.]

[2] R. DeC. Ward: Mean Annual Rainfall of the United States, with Notes on the New Chart of Average Annual Precipitation from the "Atlas of American Agriculture" (Advance Sheet), *Monthly Weather Rev.*, Vol. 45, July, 1917, pp. 338–345; chart. [Noted in the *Geogr. Rev.*, Vol. 5, 1918, pp. 325–326.]

for September, 1919.[3] These new charts mark a very decided advance over all the earlier ones and are now and will for years remain the "standard" series. They are based on a large number of records (3,600). The stations are well distributed over the country. The records were all reduced to the uniform period of 20 years, from 1895 to 1914, about 1,600 cases being actual averages for this period (short breaks being interpolated), and the remaining 2,000 having been reduced to this same period by the method described in the *Monthly Weather Review*, Vol. 45, May, 1917, pp. 333–335. Further, the isohyetal lines were drawn on hachured base maps, and in locating the lines reasonable attention was paid to topographic controls. The scale of the present maps is 1:12,200,000. They are 11 by 7 inches in size. Isohyets are drawn for 0.5 inch, and then for every inch, or for greater intervals in cases where the lines are crowded.

The charts which accompany the present review (pp. 176, 177) show the mean average precipitation over the United States for the four seasons. They were redrawn, with some slight modifications and a few omissions, from the corresponding charts published in the *Monthly Weather Review.*

The Larger Facts Brought Out on the Charts

A general glance at the new maps brings out three striking facts. (1) On the Pacific coast there is a well-defined seasonal migration, northward and southward, of a zone of rainfall which, in some months, may be considered to overlap the Sierra Nevada-Cascade barrier and expand over the northern and southern Plateau areas. These rain conditions are associated with the poleward and equatorward migration of the storm belt, as well as with seasonal changes in temperature over the land which offer the best opportunities for condensation in winter. (2) Over an extended area between the Rocky Mountains and the Mississippi River the rainfall lines advance northward and westward in spring and early summer and retreat southward and eastward in late summer and autumn. That is the conditions favorable for heavier rainfalls move from the Gulf of Mexico up the Mississippi Valley and out over the Plains and then back again. These fluctuations are associated with the development, as the continent warms, of a system of inflowing warm winds, carrying abundant moisture, and with the gradual replacement of this régime, as the continent cools, by a system of outflowing winds. (3) The eastern half of the country shows less difference between the rainfalls in the several months than the western. The districts of greatest fluctuation are along the southern Atlantic and Gulf coasts. In the eastern sections, the decreased cyclonic rainfall of the warmer months is largely or wholly compensated by frequent summer thunderstorms, while along the southern coasts West Indian hurricanes give heavy

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[3] J. B. Kincer: The Seasonal Distribution of Precipitation and its Frequency and Intensity in the United States, *Monthly Weather Rev.*, Vol. 47, September, 1919, pp. 624–631; charts. [Brief reference was made to this publication in the *Geogr. Rev.*, Vol. 9, 1920, pp. 67–68.]

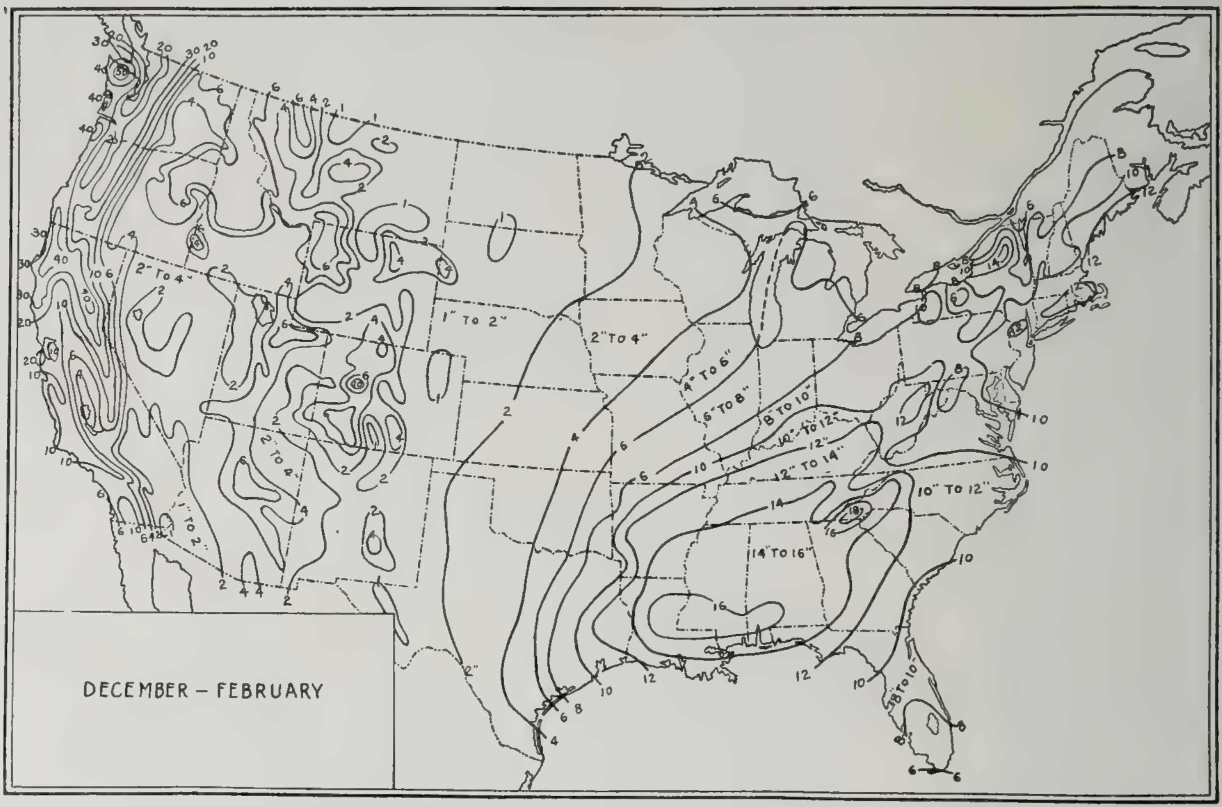

FIG. 1—Map showing the average winter rainfall of the United States. Scale, 1: 45,000,000.

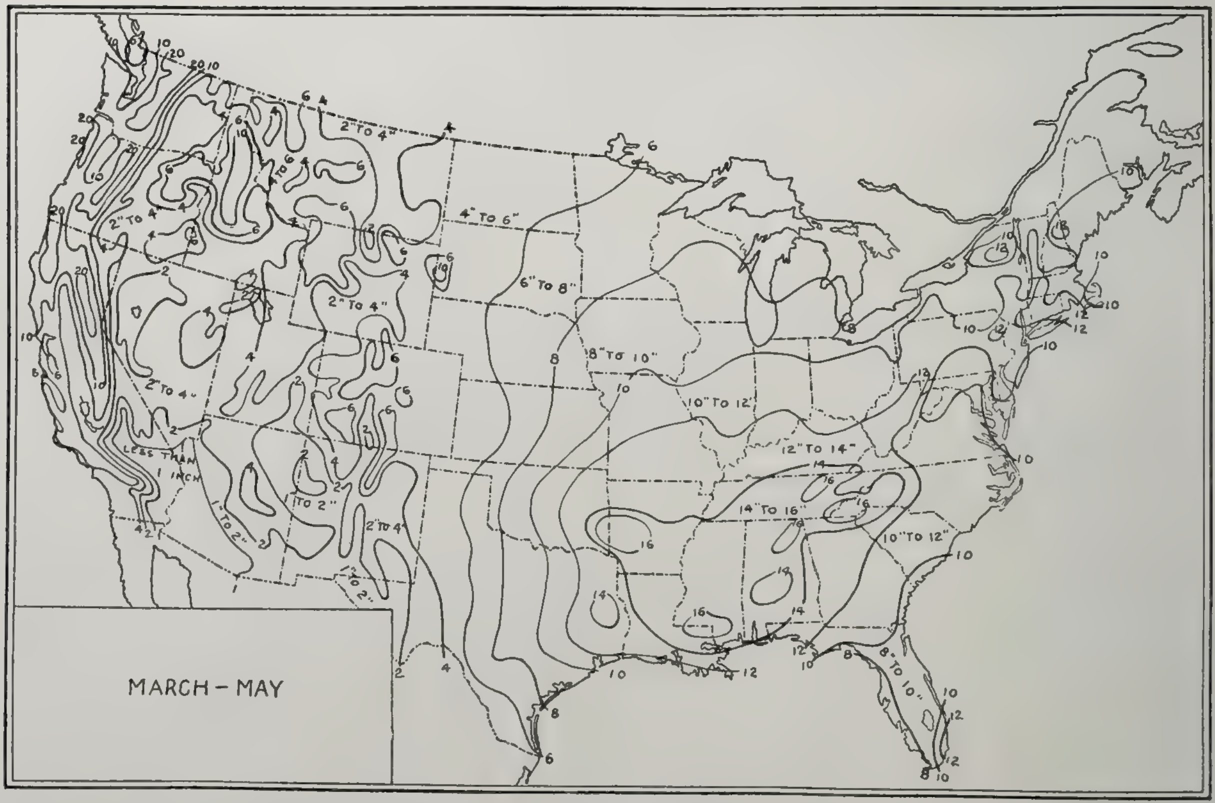

FIG. 2—Map showing the average spring rainfall of the United States. Scale, 1: 45,000,000.

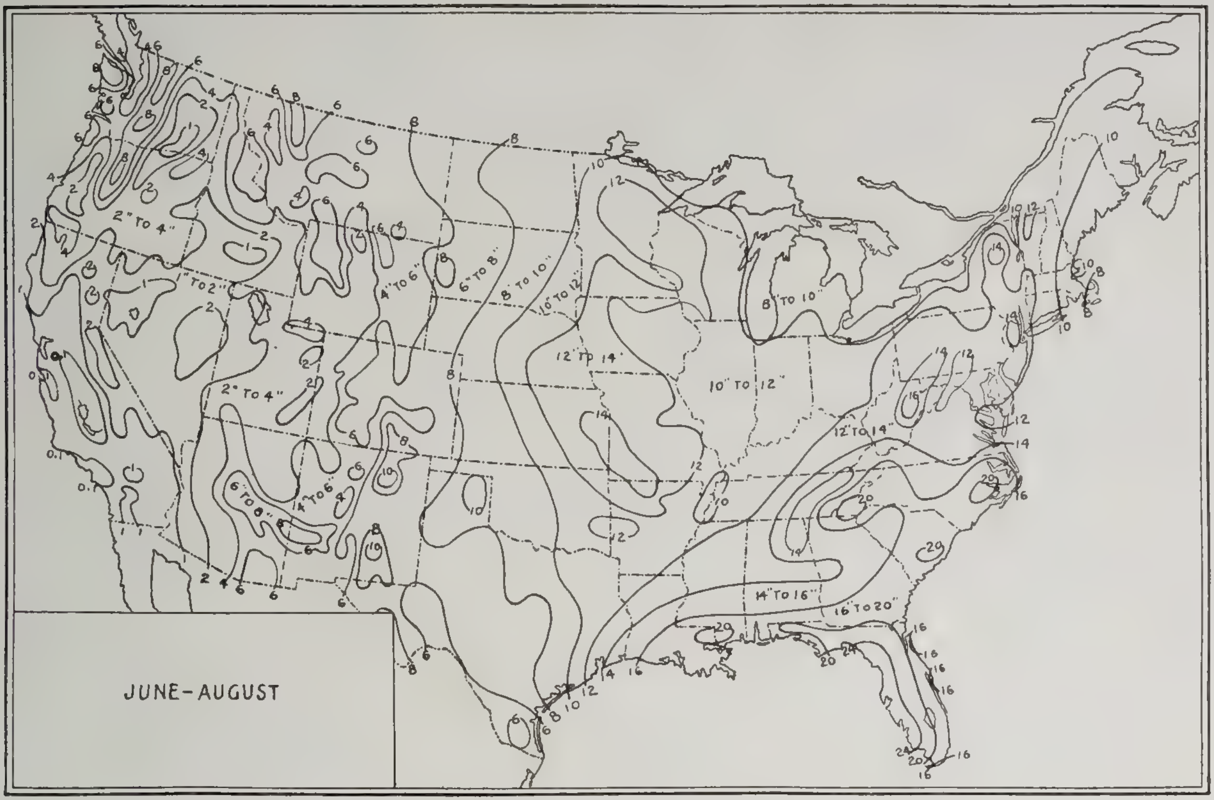

FIG. 3—Map showing the average summer rainfall of the United States. Scale, 1: 45,000,000.

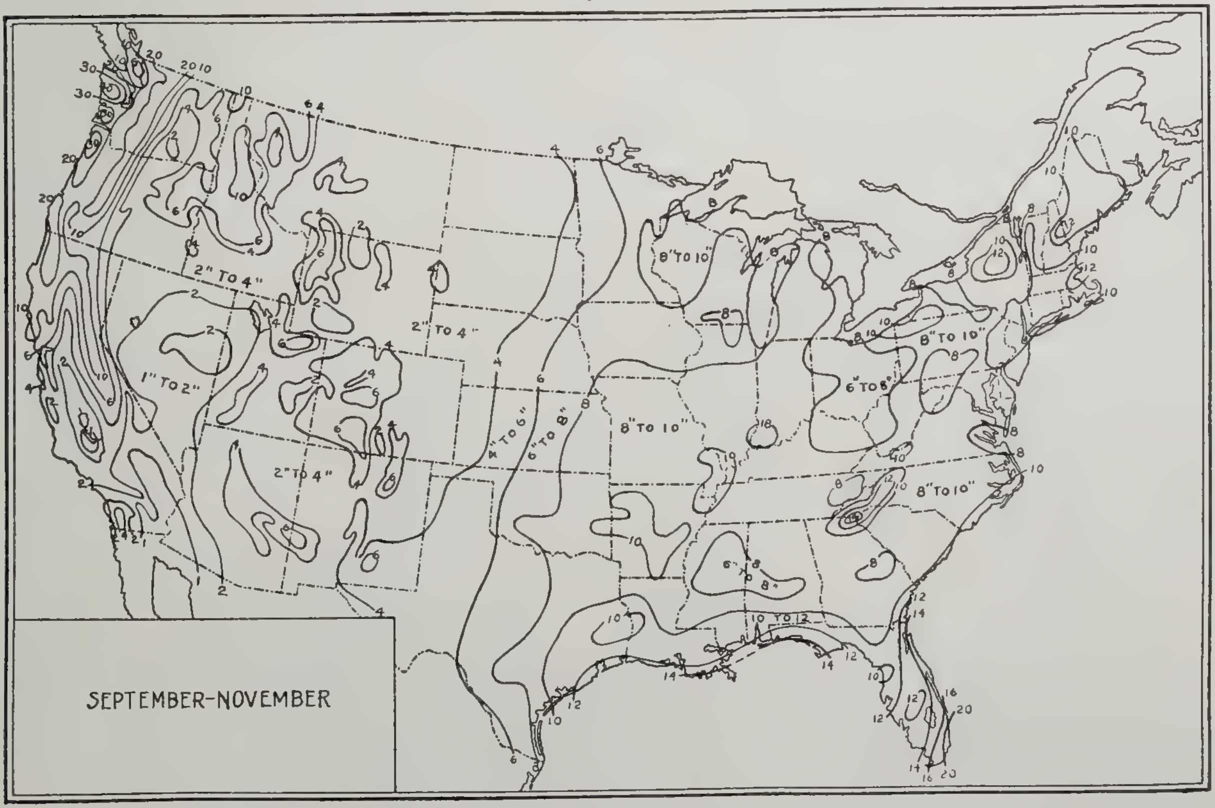

FIG. 4—Map showing the average autumn rainfall of the United States. Scale, 1: 45,000,000.

though more or less local and irregular downpours in the late summer and autumn months.

THE PACIFIC COAST [4]

The seasonal fluctuation in rainfall on the Pacific slope is, on the whole, the most striking feature on the charts. When the four seasonal charts are examined in their logical order, the winter maximum is seen to grade through a spring with decreasing rainfall to a summer minimum. Autumn follows with a general increase over the whole slope. This is the type of rainfall known as the "Pacific." [5] The topographic influences upon the seasonal amounts stand out with remarkable distinctness. In winter considerable portions of the Cascade and Sierra Nevada Mountains have over 30 inches. The northern portion of the Coast Range locally has over 40 inches, with over 50 inches on Mt. Olympus, on the extreme northwestern coast of Washington. The valleys and lowlands have distinctly less rainfall. In Washington and Oregon most of the lower land is enclosed by the 20-inch line, while farther south the Great Valley of California averages below 20 inches; much of it has less than 10 inches, and the southern portion even less than 5 inches. On the immediate seacoast the winter rainfall decreases from north to south from 30–40 inches to less than 6 inches.

Summer is the driest season. The maximum rainfalls on the mountains are nowhere 10 inches, even in the north, while the valleys have roughly 2–4 inches in the north and under 0.1 inch in the southern portion of the Great Valley of California. Spring and autumn are intermediate seasons and have intermediate amounts of rainfall. This marked seasonal migration, poleward and equatorward, of the rainfall conditions on the Pacific coast is still better illustrated on the monthly charts.

From March to July and August there is a striking and interesting withdrawal, up the Pacific coast, of the zone of winter rains, dependent upon the northward retreat of the storm belt and upon the gradual warming of the land. By April the maximum monthly rainfall on the coast in the extreme northwest, is 6–10 inches; 1–2 inches occur in the region about San Francisco, and 0.5 inch on the southern coast. The 1-inch line on the coast is slightly north of San Francisco in May. In June it is on the northwestern California coast. The July map shows the minimum of the Pacific type, i. e. the extreme northward migration of the winter rains. Only a small area in the northwest and the upper slopes of the Cascade Mountains have rainfalls of more than 1 inch. From August through to December the belt of winter rains is moving southward again. Each month shows an extension of the area covered and an increase in the amount of precipitation. Thus for the central California coast, in the district immediately adjacent to San Francisco, this monthly increase is clearly indicated by the following amounts of rainfall: August, a trace; September, 0.5–1 inch; October, 1–2 inches; November, 2–3 inches; December, about 3 inches.

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[4] For a map of the climatic provinces which are used as the basis of the following discussion see R. DeC. Ward: Climatic Subdivisions of the United States, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 672–680, Figure 5, on p. 678.

[5] For a discussion of the rainfall types referred to in this article see R. DeC. Ward: Rainfall Types of the United States, *Geogr. Rev.*, Vol. 4, 1917, pp. 131–144.

THE PLATEAU PROVINCE

The Plateau province lies in the rain shadow of the Cascade-Sierra Nevada ranges. Its seasonal rainfall has both marine and continental characteristics. The cold-season rainfall of the Pacific coast may be considered as extending across the mountains into the western portion of the Plateau, causing the primary or secondary winter and early spring maxima of this interior district, these rains being heavier in the north, where there is the greatest cyclonic activity ("Northern Plateau type"). Over the northern plateaus the seasonal amounts decrease from winter to summer, both on the mountains and also over the lower portions of the district. The southern Plateau has its driest seasons in autumn and spring, with the primary maximum in summer ("Southern Plateau type"). As illustrating these points, the following broadly generalized seasonal rainfall amounts for different parts of the Plateau province are here given.

TABLE I — SEASONAL RAINFALL IN THE PLATEAU PROVINCE

SEASON	NORTHERN PLATEAU		SOUTHERN PLATEAU	
	LOWER ALTITUDES	MOUNTAINS (EASTERN)	LOWER ALTITUDES	MOUNTAINS
Winter	About 4″	6″–10″+	1″–4″	4″–6″
Spring	<2″–4″	6″–10″+	<1″–2″	2″–4″+
Summer	<2″–4″	4″– 6″+	<1″–4″	6″–8″+
Autumn	2″–4″	6″–10″+	<1″–4″	4″+

THE GREAT PLAINS

The second striking feature on the charts concerns the seasonal fluctuations of rainfall over the Great Plains. In winter the 100th meridian marks about the average western limit of a seasonal rainfall of 2 inches for the eastern United States. In the north, the 2-inch line is well east of the Plains, reaching central Minnesota, while there is a slight extension to the west of the 100th meridian in Texas. The 2-inch line crosses the meridian in Kansas. From month to month as spring advances, the rainfall lines over the great central lowlands move northward and westward from the Gulf of Mexico. The conditions favorable for increasing rainfall progress inland as the gradual heating of the continent develops a system of inflowing, damp winds which, in a sense, carry the rainfall lines with them. In

March the 1-inch line is about on the 100th meridian; in April the 2-inch and in May the 3-inch line occupies roughly this same position. The spring map shows that the rainfall along the eastern margin of the Plains has increased to three times that of winter (6 inches as against 2 inches). This westward migration is at its maximum in June, when there are monthly rainfalls of more than 3 inches over considerable portions of the eastern and northern Great Plains. The charts thus indicate very clearly the progress of conditions which give the spring and early summer maxima of the "Eastern Rocky Mountain Foothills," and of the "Missouri" rainfall types. The pronounced northwestward extension of these rainfall maxima appears in the trend of the rainfall lines in June.

In July the swing of the sun southward after the summer solstice, and the passing of the conditions which gave the early summer maxima, result in a retreat of the rainfall lines eastward across the Plains. This retreat is greatest and most rapid in the north, where the westward advance was the greatest. In the south between, June and July, instead of a retreat there is a distinct extension westward, over New Mexico and Arizona, of rainfall conditions of 2–4 inches. This is the map evidence of the approach of the late summer maximum, due essentially to local convectional rainfalls, of the "New Mexican" and "Southern Plateau" types. The general eastward withdrawal of the rainfall lines over the Plains continues month by month until winter. The seasonal rainfall amounts along the eastern margin of the Plains are as follows: winter, 2 inches; spring, 6 inches; summer 8–10 inches; autumn, 4 inches in the north to 6 inches in Texas. This great seasonal migration of rainfall conditions over the area west of the Mississippi River, over the Great Plains, so clearly seen on the rainfall charts, brings to mind the economic importance of the warm-season rains in that region. The approach of the time of rainfall maximum is anxiously awaited by the farmers. Upon the proper distribution of the rain, in time and in amount, depends the success of agricultural operations over vast areas of these western states.

The Eastern and Gulf Provinces

The third large fact illustrated by the charts concerns the rainfall of the eastern United States. It is apparent that, on the whole, the distribution of rainfall throughout the year is generally more uniform in the east than in the west, although there are certain sections of the country east of the Plains where the seasonal fluctuation is well marked. Thus, the westward migration of the rainfall lines in spring and summer, referred to in the preceding paragraphs, is a striking characteristic of the Mississippi-Missouri Valley region. Other seasonal fluctuations shown on the charts are (1) the winter and (early) spring rainfalls of the "Tennessee type," followed by a drier summer and autumn, and (2) the marked (late) summer and (early) autumn rainfalls along the Gulf and southern Atlantic coasts

("Atlantic," "Florida," "North Gulf Coast," and "Texas" types). The generalized seasonal amounts of rain along the Gulf coast are:

TABLE II—SEASONAL RAINFALL ALONG THE GULF COAST

SEASON	FLORIDA	LOUISIANA	TEXAS
Winter	6″–14″	12″–14″	4″–12″
Spring	8″–14″	12″–14″	6″–12″
Summer	16″–24″	16″+	6″–14″
Autumn	12″–20″	12″–14″	8″–12″+

A comparison of all the charts shows a general decrease over the eastern United States as a whole from the warmer to the colder months. Autumn is on the whole the driest season. It further appears that the rainfall charts for the summer months resemble the mean annual rainfall map somewhat more closely than do the charts for the winter months. The warm-season rains, therefore, are the dominant control in eastern sections. The continental type, of late spring, summer, and early autumn rainfalls, covers a larger area and is more important than the cold-season rains. Some twenty-five years ago Harrington calculated the seasonal rainfalls of the United States as a whole. The rainfall of summer is the heaviest; then that of spring, with winter third, and autumn the driest season. The dominance of the continental type of warm-season rains is thus clearly brought out. Observations now available, covering longer periods and from more numerous stations, would give different amounts but would not alter the order of seasons above named.

THE PEARL FISHERS OF TORRES STRAITS ISLANDS

By Thomas J. McMahon

The islands of Torres Straits, directly north of Queensland, Australia, vary in size from a mere patch of sand or coral to fifty square miles in area. Only the larger ones are inhabited, the islets being used either as fishing stations or, if the soil is fertile, for native gardens.

The Islanders

Thirty years ago the fortune hunters of the world realized the worth of the Torres Straits pearls, and a rush set in to rake the bottom of the shallow sea. This brought many unscrupulous adventurers, who began to exploit the Torres Straits islanders, finally bringing them into slavery and almost to the point of extinction. The men were seized and kept almost constantly at work as divers; the women were scattered; separation from home and children ensued. Thus, with broken hearts and weakened bodies, a once high-spirited people succumbed to sickness, famine, and disease. About this time the evils of the industry came to the notice of the Queensland Government. The "Aborigines Protection Act" was passed to check any further ill-treatment of the natives. The "protectors," as the government inspectors were called, assisted by the missionaries of the London Missionary Society, began to encourage and enforce humanitarian ideas. As a result of these reforms, the natives are today a highly industrious, intelligent, and thriving people. Both men and women are tall, with regular, well-formed features that have attracted the attention of travelers and scientists. Their high state of moral and physical vigor is reflected in the fact that they are self-supporting. They not only support their families, their sick, and their aged, but also maintain without government aid their own institutions, such as municipal boats, churches, and schools. Sources of revenue are found in the main industries of the islands, in pearling, and the collecting of *bêche de mer.* The Government merely pays the teachers, the white administrators of the islands.

From the nature of their industries the islanders are born seamen, with an instinctive knowledge of the coral reefs and the movements of the uncertain winds for which the Straits are noted. No white man can take a lugger through the tidal rips and many other dangerous places around the islands with the ease and nonchalance of the native, who is remarkable for the skill with which he handles a swiftly speeding lugger, turning her within her own length in order to avoid some reef visible only to his keen eyes. The Straits are full of wrecks occasioned by foolhardy attempts of other navigators to sail the treacherous waters with their hidden coral reefs and complex tides and currents.

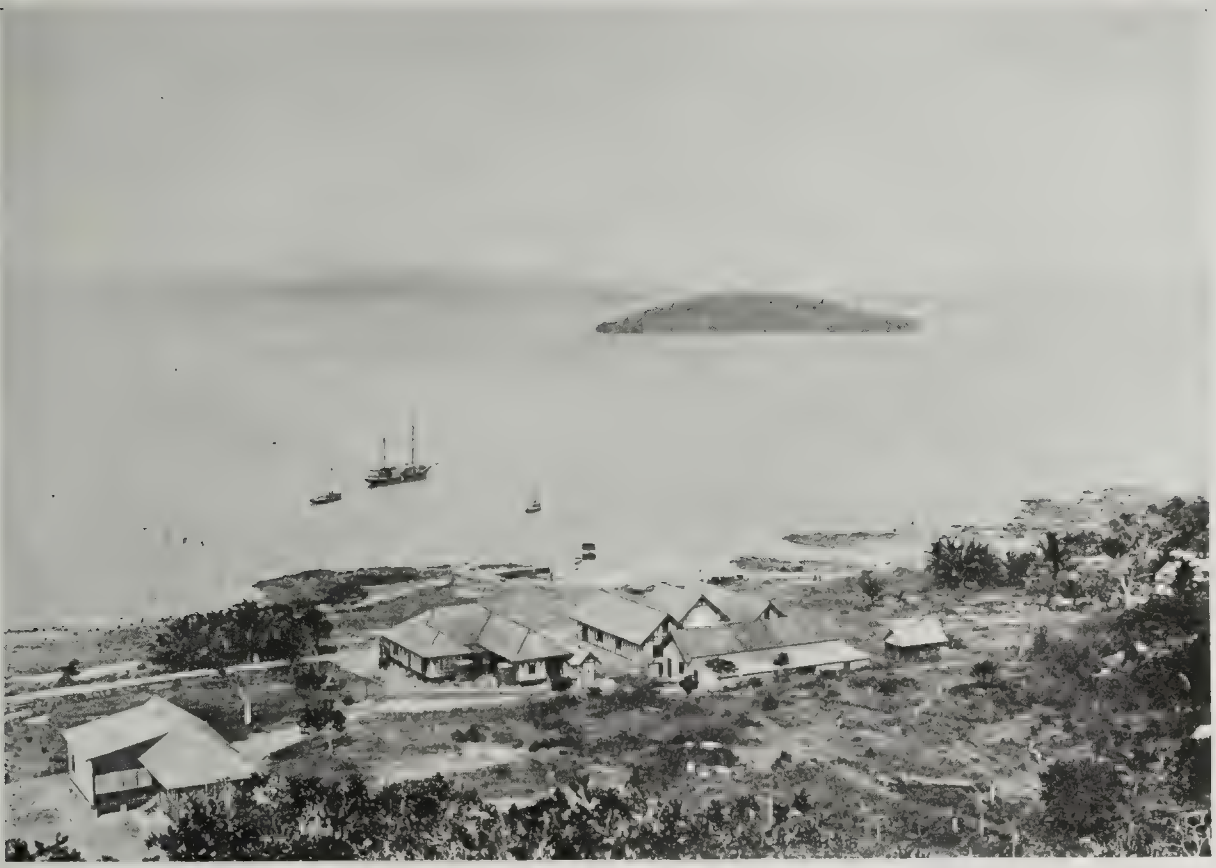

FIG. 1

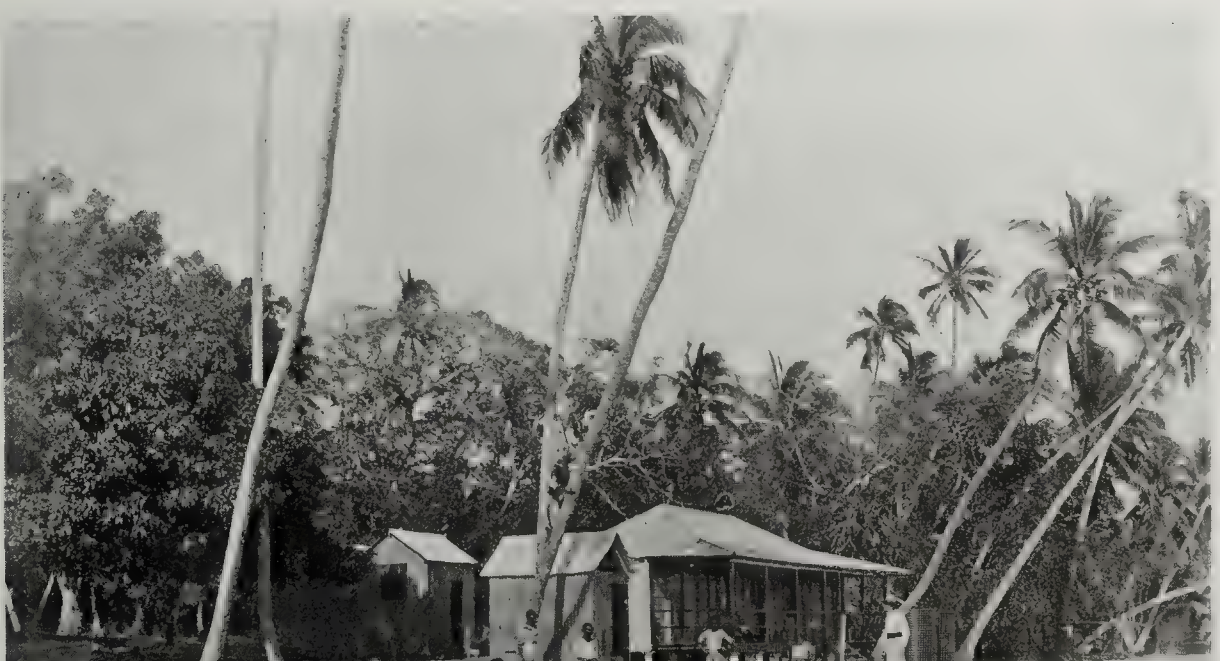

FIG. 2

FIG. 1—A pearling station in the Torres Straits Islands
FIG. 2—The white administrator's home, Murray Island, Torres Straits

CHARACTERISTICS OF THE VARIOUS ISLANDS

Every island has features of particular interest in its history, its people, its scenic beauty, or its scientific importance. Mulgrave Island, more generally known as Badu, is famous for the prosperity of its people and their ready adoption of old English dances taught them by English missionaries many years back. The women make a most beautiful lace of fine quality. Mabuiag Island is distinguished by a remarkable native festival held every five years, to which natives flock from all parts of the group. This festival, once notorious as a gathering of warriors indulging in many savage rites often resulting in massacres, is now an interesting affair under the auspices of the Anglican Mission.

Yorke Island is noted for its history. It was off its palm-bordered shores that Spanish ships sailed hundreds of years ago. Many were wrecked in the coral-strewn waters, and to this day the sea is constantly giving up strange cannon, guns, swords, and old coins. The island was the home of "Yankee Ned," an American sailor who fled from his ship of war, amassed a great fortune in pearls, and married no less than eight native wives leaving numerous descendants.

Darnley Island has amazing native fish traps. These completely encircle the island and are in all sorts of figures, shapes, and sizes. They are made of gigantic boulders. It is difficult to see how they were brought into place. The natives have a tradition that the traps were made by great black giants who used the Islands of the Torres Straits as stepping-stones from Australia to Asia and were in the habit of picking up and throwing at each other in play these boulders, some at least 3 to 4 tons in weight. The natives account for the shapes of the traps by saying that the giants threw handfuls of boulders at one another and that they formed the squares, circles, and figures of eight.

Murray Island and its immediate waters are well known to scientists from all parts of the world. Owing to the various colors of the coral the effect of the sun shining on the sea is extraordinarily beautiful. Murray Island is also termed "The Garden Isle" for its beauty of hills, golden shores, native villages, and the profusion and variety of tropical plant life. Thursday Island, the capital of the group, is an important outpost of the British Empire inasmuch as its forts dominate the narrow straits through which steamers pass.

All of the island villages have strict health regulations. The result is freedom from epidemics. The native councilors, easily distinguishable by the word "Councilor" in white letters on the front of their red jerseys, are men of fairly high intelligence and strong personality. They are either elected by the people, or, in the case of a deadlock of votes, appointed by the administrator. It is part of their many duties to see that the villagers keep their houses, food, and clothing clean, that they send their children regularly to school, and that church is attended. They also visit the native gardens to see that they are properly tilled, and planted to their full capacity.

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

Relics of Arctic Expeditions Deposited with the British Admiralty and the Royal Geographical Society. The Crocker Land Expedition of 1913–1917 brought back to this country an exceedingly interesting collection of relics and souvenirs of earlier Arctic expeditions. As one of the three institutions that supported the Crocker Land Expedition the Society received the geographical portion of this collection. Thereupon the Council of the Society, recognizing the interest of the British people in those relics and objects which related to British expeditions, offered the larger part of the collection to the British Admiralty. Through the good offices of the British Ambassador at Washington and the British Consul-General at New York the collection was recently forwarded to London for appropriate distribution. Some of the more interesting items were described in "Notes on MacMillan's Ellesmere Island Trip" in the *Geographical Review*, March, 1918. A number of the articles that were connected rather directly with the past history of that institution were offered to the Royal Geographical Society at London for exhibition in their Museum. The objects retained by the British Admiralty are now in the Royal Naval College at Greenwich. Among those retained by the American Geographical Society are three records of the Peary Expedition of 1906 and a record of Dr. Kane's Expedition of 1903.

NORTH AMERICA

The Reform of Political Divisions on a Geographical Basis. Among the different political divisions in the United States none is more unscientific and ungeographical than the congressional district, particularly in the form given to it in the frequent re-adjustment of its bounds for partisan ends. In the American Political Science Review (Vol. 12, 1918, No. 3, pp. 403–426), C. O. Sauer discusses these political units under the title "Geography and the Gerrymander." He shows how utterly congressional districts depart from being true natural or geographic units, and attempts to indicate how they could be reconstituted with due regard for geographic factors. The states of Missouri, Kentucky, and Tennessee are cited, illustrating faulty, unscientific grouping of electoral districts. In these states, according to the author, distinctly marked geographical regions have been totally disregarded in the creation of their congressional divisions.

The geographic factors which the author would take into account in the determination of "natural areas" are location, topography, soil, drainage, and mineral resources. Climate, too, would merit consideration in districts, such as the extreme west of the United States, where sharply contrasted types appear within a limited area. A geographical unit would be "one in which conditions of life are in general similar, because of similarity of environment."

That this is the natural basis for regional division in a more or less primitive condition of society will be readily admitted. But that the same principle applies in an advanced culture, based upon interchange of commodities, is not so certain. Much of the Ozark country clearly forms a distinct independent district, where similarity of environment makes for community of interests. But this is not so true of other sections of the state where the economic relationships established by an interchange of unlike productions of dissimilar environment forms the strongest bond of union; where unity depends upon diversity rather than similarity of geographical conditions. This latter principle of classification, strongly advocated by the French geographers (led by Vidal de la Blache) in their discussion of the regional divisions of France, would seem to be as truly geographic and better suited as a basis upon which to reconstitute the recognizedly unscientific electoral units established by the gerrymander.

EUROPE

The Northern River Boundary of Yugo-Slavia. On this topic an interesting brochure has recently been published by Jovan Cvijic (Frontière septentrionale des Yougoslaves, Paris, 1919). Because it was prepared in support of the Yugo-Slav claims at the Peace Conference of Paris, the analysis cannot be accepted as a definitive scientific statement, though the first part of the paper contains important geographical data. The second part also includes a section of special geographical interest dealing as it does with the problem of rivers as boundaries. The area dealt with is the Pannonian Plain where the Drave and the Danube meet. Both streams have meandering courses which are shifting toward the right. The consequence is that the thalweg of each stream is progressively displaced. Were it taken as an international boundary line, each change in the river would alter the frontier. The alternative is to fix upon a given location of the thalweg as definitive and monument it for all time.

For example, following the actual displacement of the Danube in past years the administrative frontier between the Bačka and the Baranya did not correspond with the course of the stream but with the channels of certain abandoned meanders. In the case of the Drave many minor changes of the same sort have occurred, but the principal one is the district of the so-called "Island of Repaš" (commune de Gola). Reference to the accompanying figure will show that the river once had a more northerly course which has been shifted to its present one, leaving the old course as an insignificant drainage line. The administrative boundary was fixed at a time when the river took the more northerly course; and it has been maintained in that position ever since. Farther down stream the old course of the river has also remained the administrative frontier in spite of the shifting of the stream to a more southerly position.

Such displacements of the thalweg involve endless disputes which would have to be settled by later agreements and surveys. For example, there is the case of the Drina, which, according to the Congress of Berlin (1878), became the frontier between Serbia and Austria-Hungary, thus giving rise to a dispute before a mixed commission. Almost as soon as the commission's findings were announced new displacements in the course of the river gave rise to new negotiations.

By the terms of the treaty of peace with Hungary the boundary between Hungary and Yugo-Slavia is established on the old and well-monumented administrative boundary that at one time followed the earlier course of the Drave. This puts a larger number of Yugo-Slavs in the Serb-Croat-Slovene Kingdom than would be the case if the present course of the Drave were followed. At the same time it leaves the advantages of river control equally in both hands, because each power controls both banks of the river at a number of points.

Spanish Meteorological Service and its Publications. In the field of meteorology, in its international aspects, there has been a serious dearth of available material from Spain. The lack has been felt particularly in attempts to correlate data regarding the movements of extra tropical cyclones, many of which cross the Iberian peninsula. Though observations had been made during many years, because of an unsatisfactory organization of the service the results had been inadequate and the data collected had appeared in different publications, partly in the *Anuario Estadistico de España* (1858–1864), partly in the *Resumenes de Observaciones Efectuadas en España*, issued by the Astronomical and Meteorological Observatory of Madrid (1865–1900).

In 1906 the entire meteorological service was entrusted to the Instituto Central de Meteorología, (since 1911 called the Observatorio Central Meteorológico) which forms one of the departments of the Instituto Geográfico y Estadístico. A marked improvement resulted. That office is now issuing in consecutive form the data collected during many years by the different organizations, official and cooperating. These appear in the *Resumen de las Observaciones Meteorológicas* of which volumes 5 to 12, covering the years 1901 to 1916, have recently been issued; and in the *Anuario del Observatorio Central Meteorológico* which, with its *Suplemento* contains also various studies of meteorological and climatic conditions in Spain. These studies cover such subjects as *Tormentas* (thunder-storms). Cyclones and Anticyclones, Rain Zones, Early Frosts, Aerology, etc. The usual maps are employed to show atmospheric pressure, temperature, rainfall and the paths of storms. In addition to reports of stations maintained on the peninsula, data from four points along the north coast of Africa and from the Canary Islands are included. On the island of Tenerife, where formerly existed the international aerological station, there is now established a similar Spanish observatory, which, besides the usual meteorological observations, records solar radiation and conducts investigations of upper air conditions. This observatory is situated 7,740 feet above sea-level near the base of Mount Teide. The results of the observations made there are published in the *Suplemento* to which reference has already been made (see *Anuario del Observatorio Central Meteorológico* Vol. I, (1916) and José Galbis y Rodríguez, Estado Actual de Nuestra Organización Meteorológica; *Ibérica*, Jan. 18. 1919, pp. 40–44.)

AFRICA

An Over-populated Island. In an extraordinarily limited environment the natives of Bukara (Ukara) Island in the southeastern corner of Lake Victoria Nyanza, have multiplied until today they number 19,000 on an area of only 36 square miles, and much of that is bare granite. There is "hardly a tree of respectable size to be seen anywhere." The climate is hot and stormy and marked by heavy rainfall which works havoc with the exposed fields. Faced by social and physical problems of the most trying kind, and isolated from the rest of the world, the natives have developed great ingenuity in solving the problem of survival

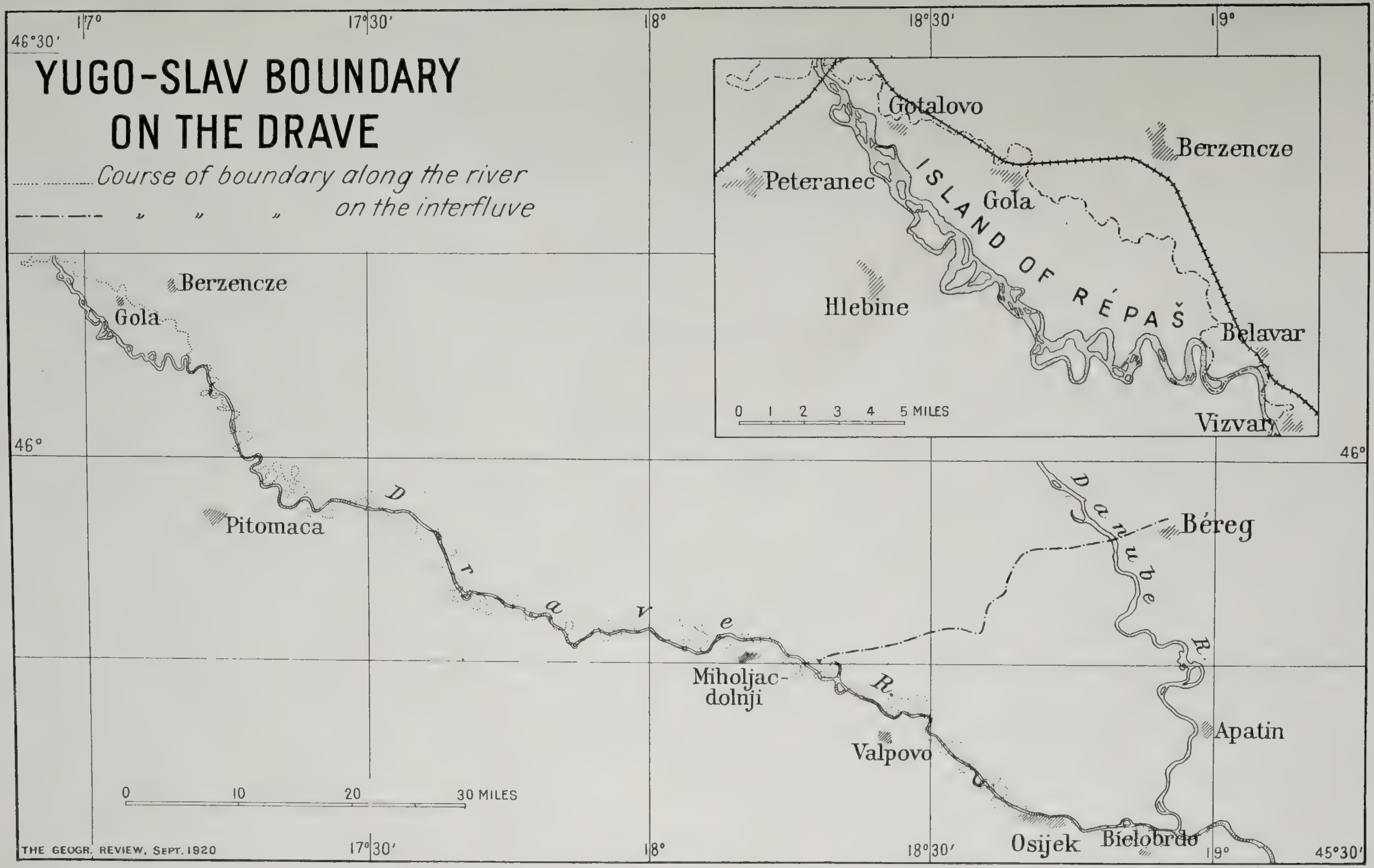

FIG. 1—North of the Drave is Hungary; south of it is the "Kingdom of the Serbs, Croats and Slovenes," or Yugo-Slavia. Where the common boundary of these two states lies close to the river it is represented by a dotted line in order to show detail more clearly. Between the Drave and the Danube the boundary is represented by a dot-and-dash line. The inset shows details of river and boundary at the Island of Repaš where the former course of the Drave, now an almost dry channel, is represented by a dot-and-dash line. The inset also shows the complicated relations of the new boundary and the railway at Gola. The scale of the main map is 1: 1,000,000.

in a state of over-population (H. L. Duke, Bukara Island, *The Cornhill Magazine*, June, 1920, pp. 705–710).

Economy has been carried to the point where every fertile area is used for village sites, gardens, or grazing-grounds. Each garden plot has an extent of 80 to 100 yards by 30 to 40 yards and is marked off by granite boundary stones, trees, or bushes. Rights of ownership are rigidly observed. As in the case of the native holdings of parts of the Anglo-Egyptian Sudan, the trees are valued more than the land on which they grow. One man may own the trees and another the ground: "a tree, if properly exploited, is a priceless possession." A man must not even steal his neighbor's leaves nor his sticks nor his rubbish! A father may even divide a tree among his children apportioning certain branches to each. There is the utmost economy in the use of the soil and the collection of fertilizer for it.

In addition to small individual holdings of grassplots for pasture there are communal holdings by villages. Mature grass is carefully husbanded for thatching, never burnt as among so many natives elsewhere. "It belongs to the chief, who doles it out to his subjects as required."

Artificial stone and earth embankments check the loss of the soil. A deposit of clay is worked for pipes and cooking pots but some clay has also to be imported from the mainland fifteen miles away. The steep-roofed huts are divided into two compartments, one for the native, the other for his cattle. Food is ground on flat rock surfaces, not in mortars. Twins and triplets are killed though the white man's coming will doubtless change this custom. It would seem that the limit of population capacity has been reached on Bukara and that emigration to the mainland must follow in the years to come.

A Recent Study of the Rift Valleys of Africa. Among the major relief features of the earth the African Rift Valleys are certainly one of the most interesting. Treated by one who has known them intimately for many years and who has recently extended his field observations they are seen to be as important in systematic physiography as they are attractive scenically (J. W. Gregory, The African Rift Valleys, *Geogr. Journ.*, Vol. 56, 1920, pp. 13–47).

After a spirited and clear description of their physical features and their extraordinary extent from Palestine to South Africa (illustrated with photographs and topographic sections) the author comes to the explanatory portion of his theme and here there is much to criticise. Almost nowhere does one obtain actual data respecting the evidence of the structural faults. There is always an obvious assumption that steep rock walls disposed in linear fashion, and often in opposition, on either side of a broad valley of flat or gently rolling relief, must mean faulting. No geologic sections are given, only the ground plan and topographic profiles. This is all the more surprising in view of the fact that much geologic evidence is supplied concerning the age of significant deposits and the character of the rock in an attempt to determine the sequences of topographic development.

The author's use of theory is startling and reaches its climax in the last paragraph where the difference in character of the American and African earth movements is explained by their antipodal relation. "Africa was antipodal to the Pacific, and it is in accordance with the well-known antipodal relation of ocean to continent that while the Pacific was sinking and the crust beneath it undergoing compression, its antipodal land should be rising and subject to tension." The uncritical nature of the statement is hidden from the layman by a beguiling assurance and plausibility of statement which is almost an integral part of the author's style. In the statement "Nor is there anything in America to correspond with the long tension rent of the Great Rift Valley" the author apparently overlooks the claims of the Rocky Mountain trenches of which the principal one extends in an almost straight line for 900 miles (R. A. Daly: The Nomenclature of the North American Cordillera between the 47th and 53d Parallels of Latitude, *Geogr. Journ.*, Vol. 27, 1906, pp. 586–606). While the rifts of the basin-range country of Nevada do not have the extent of the narrow and elongated rift valleys of Africa there is a correspondence of structure and process, and locally of relief, if the foundered structural arches and youthful fault scraps be considered.

AUSTRALIA

A Special Form of Sub-surface Drainage in Australia. There is a fairly wide distribution of certain features of minor drainage in Western Australia that appear to have considerable physiographic significance, according to a recent account published by M. Aurousseau (Proc. Linnean Soc., New South Wales, 1919, pp. 826–827). In the region in which it occurs—on the flanks of the Darling Range—the slopes are soil-covered, and the forms are developed in the piedmont deposits on the margin of the slopes. There occurs a series of small holes of different sizes up to a foot in diameter and three feet deep, spaced irregularly along definite lines. These holes also occur on the steeper soil-clad slopes. Their walls are steep. The sub-surface channels with which they are related have no relation to contour. It appears that the sub-surface drainage is formed in fissures in the sub-soil that develop in the hot dry summer and into which the heavy winter rains sink. The water flows along the fissures which then become widened into definite underground channels, with slumping from above thus bringing about surface pits and depressions. It appears that apart from its physiographic effects the matter has importance in diverting a larger part of the rainfall to underground reservoirs than would otherwise be the case.

PHYSICAL GEOGRAPHY

The Evolution of Climate. Climatic studies in recent years have furnished a meeting ground for geographers and geologists perhaps more extensive than any that has been supplied outside of the technical study of land forms and their dates of origin. A recent contribution to the subject deserves special notice because of its critical quality and the nature of its conclusions (Evolution of Geologic Climates, by F. H. Knowlton, Bull. Geol. Soc. Amer., Vol. 30, 1919, pp. 499–565). It would require too much space to review in detail the successive arguments of the author. He has analyzed the subject principally from the standpoint of paleobotanical evidence. He then turns to the consideration of the atmosphere, sources of heat both within and without the earth, the effect of ocean temperatures, and the convergence of these factors, at least in part, upon the character of plant life. It is the latter part of the paper that lies more particularly in the geographical field, since it relates to the shifting of the position of the poles, changes in atmospheric and deep sea circulations, the effect of volcanic dust, etc.

The conclusion of the author is that the non-zonal climates of the past, and particularly the conditions of polar geniality of climate and tropical or subtropical glaciation, prove fatal to the hypothesis of solar control. He believes that the sun was not the dominant factor in maintaining temperatures on the earth during recorded geologic times. In his view it is the earth itself that has supplied the greater amount of heat that went into the disturbance or modification of the solar régime. He leaves untouched the question of the source of the heat, whether in the form of original earth heat or some augmented form of radioactivity, or a combination of these two.

Solar Variations and the Weather. Meteorologists are viewing with considerable interest the establishment of a new solar constant station in the Harqua Hala Mountains of Arizona and the removal of the Calama station, Chile, to a nearby mountain peak. The former will probably be in operation by October, 1920. Since 1912, when nearly simultaneous determinations of the solar constant of radiation at Bassour, Algeria, and at Mount Wilson, California (Smithsonian Astrophysical Observatory), seemed to show synchronous variations in the intensity of sunlight reaching the outer limits of the atmosphere, there has been until recently an unquestioning acceptance of Dr. C. G. Abbot's theory of short-period variations in the solar output of heat that reaches the earth. Determinations made day after day during several summers at Mount Wilson and, since July, 1918, throughout the year at Calama, Chile, have showed variations which in the course of a few days amount to 5 or even 10 per cent. Meteorologists began to look for earth effects, and Mr. H. H. Clayton showed that small variations in temperature and indirectly, therefore, in pressure occurred a few days following the variations in the determined values of the solar constant (see abstract in *Geogr., Rev.*, Vol. 5, 1918, p. 244). Encouraged by his results, Mr. Clayton subjected the solar constant data and subsequent weather in Argentina to a more rigid mathematical comparison, and published an interesting paper (*Smithsonian Misc. Colls.*, Vol. 71, No. 3, 1920), the most important point of which was that the temperature at Buenos Aires reached well defined maxima about 3½ days after high values of the solar constant as determined at Calama.

At this juncture, Professor C. F. Marvin made a thorough statistical analysis of the 1,500 determinations of the solar constant by the Smithsonian Astrophysical Observatory, and published a short note in the *Monthly Weather Review* summarizing his findings (Mar., 1920, Vol. 48, pp. 149–150). These determined values must include not only the variations of the sun, but also the small observational errors and those due to changes in atmospheric transmission during the course of the series of observations made for each determination of the solar constant with the bolometer (an instrument which measures the heat value of different parts of the solar spectrum). As instrumentation has become more accurate, the apparent variability of the solar constant has become less. Also, a recently introduced, short-cut, empirical method for getting the solar constant, from essentially one observation with a pyranometer, seems largely to have eliminated the errors due to changing atmospheric transmission, with the result that the variations in the solar constant as determined by it, are appreciably smaller than those obtained with the bolometer. Even if the instrumental and observational errors are set at a very small figure, it seems that solar variations must be very small.

But forecasters at Buenos Aires and, as I have been told, at Rio de Janeiro, are using the Calama data, received daily by telegraph, to forecast temperature. The 3½-day interval between high values at Calama and high temperatures at Buenos Aires becomes a 5-day interval at Rio. It is possible, though it seems unlikely, that the variations in the solar constant as determined at Calama and in the temperatures farther east are due to atmospheric changes that reach Calama first. But how else than by the interception of sunlight by travelling clouds of electrons can the marked drop (about 7 per cent) in the solar constant observed at the time of the great aurora on March 22, 1920 (C. G. Abbot, *Monthly Weather Review*, April, 1920, Vol 48, pp. 227–228, Washington, April 28, 1920) be explained?

If the sun does vary appreciably, the simultaneous determinations of the solar constant in Arizona and in Chile will show synchronous changes. If it does not, the establishment of additional solar constant stations may prove necessary to discover what variations there are. The Weather Bureau is now embarking on a thorough investigation of what synchronisms or sequences there may be between the solar constant as determined, and various weather elements, especially temperature (*Bull. Amer. Meteorol. Soc.*, June, 1920, Vol. 1, p. 62).

Charles F. Brooks

GEOGRAPHICAL NEWS

Change in Scope and Title of *The Plant World*. The publishers of *The Plant World* announce a change of title to *Ecology*, beginning with the January number, 1920, which becomes Volume I, Number 1, of the new publication. A foreword by Barrington Moore, President of the Ecological Society of America, outlines the scope of ecology. There is a reference to geography as human ecology and the first number contains a paper by Ellsworth Huntington, entitled "The Control of Pneumonia and Influenza by the Weather." There is also a continuation of A. E. Douglass's studies on the growth rings of trees in a paper entitled, "Evidence of Climatic Effects in the Annual Rings of Trees." The principal conclusions of this paper show a very marked advance in the complicated studies of the meaning of rings of growth in terms of climatic factors (see also the review of "Climatic Cycles and Tree-growth on p. 195 of this *Review*). On account of their importance and the possibilities of extending Douglass's methods in widely separate areas of the world, the conclusions are here quoted in full.

"1. Trees probably integrate, and may be made to disclose to us, climatic combinations advantageous to certain types of vegetation.

2. The study of this subject promises to enable us to outline what might be called agro-meteorological districts, that is areas over which exist similar advantageous combinations of weather elements.

3. The application of the criterion of mean sensitivity promises to make possible the proper selection of sequoia records, which in turn will give much climatic information about the last 3,200 years.

4. Information regarding suitable forests for similar study, located in central and other parts of North America, will be greatly appreciated by the writer."

GEOGRAPHICAL REVIEWS

Territorial Problems of the Peace Conference

C. H. Haskins and R. H. Lord. **Some Problems of the Peace Conference.** xii and 307 pp.; maps, bibliogr., index. Harvard University Press, Cambridge, 1920. 9 x 6 inches.

Publications on the Peace Conference of Paris, 1919, are of special interest to geographers because the questions of territorial boundaries and their relation to the distribution of people are necessarily discussed in practically every one of them. The map of Europe has been redrawn. The basis of the new lines, the conditions of the new settlement, the derangement or improvement of the economic life, all involve in their discussion the physical data of geography, the intricate, intimate details of relief and hydrography, of soil and climate and forests, and scores of distributional factors that relate to the earth as the home of man. In their effects on man the new conditions of life must be thoroughly analyzed from the geographic standpoint; and this it is difficult to do until new census statistics are available and old statistics officially revised. If these things be so it is well that geographers should also know a great deal of the background of the settlement, if only that they may be more discriminating in the selection and use of the available data. That background is altogether difficult to acquire. To understand this let us look at some general considerations.

So diverse were the objects of different nations and peoples during the war that no set of formulae could have been found to fit Allied purposes. When, with new hopes suddenly inflated by a sweeping victory, the Allies gathered for the settlement, they were confronted by an impossibly difficult task. No treaty could have been drawn that would have satisfied more than a small fraction of humanity. Necessarily confined to a generalized program, the preliminaries of the armistice and the Peace Conference received almost universal approval only because they were put into general terms. The moment that specific settlements had to be proposed every interested party felt betrayed. And the peoples of the whole world were all talking at once. A delegation from Orawa in the foothill region of the Carpathians came to Paris in native peasant costume to argue union with Poland; Slovene representatives came to argue against Italian ownership of Fiume; Macedonians came looking for the millenium. Opposed to these were equally earnest advocates using the same formulae, the same glittering phrases interspersed with “liberty,” “justice,” “humanity,” “self-determination.” Many of the rival arguments of Rumanians and Serbs for possession of the Banat were almost precisely the same; only the statistics were different! In the presence of admittedly doctored official statistics there was only one course to pursue—fight fire with fire. Each one of the Central European nationalities had its own bagful of statistical and cartographical tricks. When statistics failed use was made of maps in color. It would take a huge monograph to contain an analysis of all the types of map forgeries that the war and the Peace Conference called forth. A new instrument was discovered—the map language. A map was as good as a brilliant poster, and just being a map made it respectable, authentic.

The confusion of political purposes, the vast scale of the complicated negotiations, and the high stakes of the conference, tempted every journalist to dramatize his account. Never before has journalism broken down so completely in the face of a great task—a breakdown which was not altogether the fault of journalism. In consequence there is not even an approximately reliable well-rounded account of the Peace Conference in print. Its work has been written up from the political and the journalistic standpoints, not as history. Even the geographic work of the conference has been analyzed in a partisan spirit.

In the midst of this Stygian darkness it is heartening to see a light upon the way. Haskins and Lord have done the world a service. Geographers as well as historians are their debtors. These two scholars, bred in the spirit of research, think and write as men seeking to reveal truth. The first chapter is entitled “Tasks and Methods.” Its literary style and subject matter make it most interesting to the general reader. Its thirty pages are worth more than five hundred of any other book on the peace conference. The conservationists could find here a new text. A serious part of the material wastage in this world is due to our lax system of allowing poor writers to spoil good paper. A tree, even of the pulpwood variety, is surely a nobler thing than an untruthful and misleading even though chatty and apparently intimate volume.

It is the statistical matter, dealing with economic and ethnographic problems, that will be of greatest use to geographers. The authors have had the advantage of association with a large number of experts on the "Inquiry," the organization that prepared research material for the American Commission to Negotiate Peace, and they have had the further advantage of knowing men and events on the ground. They served on various territorial commissions of the Peace Conference and speak with authority and not as the scribes. Their statements of fact were tested by the fire of actual experience. The refinement of statistical expression was a constant and necessary process in all the boundary settlements.

There is, however, no pretense to make the book a geographical treatise. The avowed object is a discussion of a single theme—the territorial settlements. The specific value of the book, from the standpoint of scholarship alone, lies in its vivid and authoritative treatment of the historical setting of each problem. The people of central and western Europe are accustomed to thinking historically. Some of the strongest motives of today have their sources from deep within what might be called the historical structure as well as the relations of a people. The motivations of the western democracies are of a wholly different type. The geographer who would really understand a people or a new nation now appearing on the map cannot have a balanced or scientific understanding of his problem if he deals only with the physical setting. So much has been written on the new boundaries established by the peace treaties by way of destructive criticism that a cool and scholarly analysis is most timely and useful.

The captious critic would find most of this book thorny reading. If the new boundary in the Banat of Temesvar cuts across a score or more of drainage lines and roads, if the new boundary of Hungary requires half a hundred custom houses, turntables and stations, it is indeed a calamity. But what is the other horn of the dilemma? It is easy to picture economic injustice when new boundaries have to be laid down. Has anyone drawn better proposals on a map? The world could not have survived the blow to it had the old boundaries been followed. The present chaos is deplorable; the chaos resulting from a denial of the national aspirations of Czechs, Serbs, and Poles would have been fatal. If these states had to be established they had also to be given vitality. It will be one of the most interesting and valuable of the future tasks of the geographer and the economist to see what adaptations of frontiers, or of physical or political circumstances will be evolved as a result of the fragmentation of Central Europe and the inevitable resulting disturbances to the economy of the inhabitants. We had thought of Europe as an adjusted region where life had become well fitted to environment; we see it now, in an instant, set to pioneering again—not in the old sense, but in a political and social sense, with only the old geographical and historical foundations on which to build.

The book covers but a part of the European settlements and does not touch the other continents. For example, the Baltic states are not treated, nor is there a statement of the Turkish or Pacific or Far Eastern problems. This is due to the limitations of the lecture form in which the several chapters were prepared and the brevity of the course (Lowell Lectures). The maps leave much to be desired. An invaluable feature is the well-selected list of references partly to original and partly to secondary sources of material.

The Irrigation Problem in the Nile Basin

William Willcocks. **The Nile Projects.** xii and 184 pp.; maps, diagrs., index. [Cairo], 1919. 10 x 6½ inches.

Murdock MacDonald. **Nile Control Works.** 16 pp.; map. Ministry of Public Works, Cairo, 1919.

One of the claims of Egyptian nationalists is that Egypt is taxed for the benefit of the Anglo-Egyptian Sudan and that in the material development of the Sudan insufficient account is taken of the water problems of the lower Nile valley. These political differences between the Egyptian leaders and the British administration find a basis in a difference of opinion on the part of the engineers upon the best method of regulating the irrigation waters of the Nile. The two papers here dealt with present opposite views. Despite their controversial character the papers are of great value to the geographical student in their presentation of a clear picture of the present irrigation situation in Egypt.

The battle of Omdurman marks the beginning of the recent period in which British engineers have sought to extend the cotton lands of the Nile valley by a more conservative use of Nile waters. The two great enemies of the country are drought and inundation. Sir William divides the Egyptian year into three seasons: summer, flood, and winter. The first extends from the beginning of April to the end of July, when the Nile is at its lowest. The second extends from the beginning of August to the end of November, when the Nile overflows its banks. The third includes the months of December, January, February, and March, when the Nile is confined within its channel but carries a supply in excess of agricultural requirements.

Associated with each of these three seasons there are three groups of crops. The summer crops are cotton, sugar cane, millets, rice, vegetables, and fruit. The flood crop is maize or millets and flood rice over restricted areas. The winter crops are wheat, beans, barley, vegetables, peas, and clover. Parts of Egypt have perennial irrigation, and these can produce two or three crops a year. Others are irrigated only in flood, or if they are below the level of the Nile flood they may carry water for some time, which water is then drained off and the ground tilled. There is an elaborate statement of the problems of cultivated and uncultivated land in the several regions of Egypt and the proportion of cultivated land that receives its water supply by each of the two systems mentioned above.

Sir William emphasizes the fact that aside from flood protection the great problem of Egypt is to secure a water supply sufficient to furnish irrigation water when the Nile is low. Otherwise there is insufficient room for the very rapidly growing population, which has doubled in the last forty years and is increasing at the rate of 200,000 a year. He emphasizes particularly the value of the Sudan region of the White Nile, hitherto unutilizable, a vast waste of marsh and water which receives the flood waters of the Lake Albert region and which if properly controlled by engineering works could be made to supply all the water needed for many years to come. He would utilize the fall of the Nile to generate electrical power for lifting water otherwise unavailable. Associated with this plan is that of changing the present wasteful "basin irrigation system" of upper Egypt, which involves the flooding of low-lying bodies in the Nile Valley, to "perennial irrigation" which requires the conservation of flood waters and the pumping of the river water into the irrigation canals. The peak of the annual flood would thus be taken off and Egypt freed from all danger of inundation.

A MONTANA COUNTY GEOGRAPHY

O. W. FREEMAN. **Geography and Geology of Fergus County.** 71 pp.; map, ills., bibliogr., index. *Fergus County High School Bull. 2,* Lewistown, Mont., 1919.

This small handbook, descriptive of a county in the center of Montana, has been prepared less for school use than in response to a demand for instruction on the part of the public. It is an excellent example of the manner in which an enterprising school may itself reach out to edify the adults of the community, and it therefore deserves grateful recognition.

The first bulletin of this series, published over ten years ago, described the "Birds of Fergus County"; a third is planned on the "History and Civics" of the county, for which we trust it may not be necessary to wait another decade, and in which we earnestly hope to see expression of a vigorous and whole-souled but not boastful American spirit, clearly stating our ideals and fairly setting forth our successes but not glossing over difficulties, dangers, and failures.

The chapters of the present bulletin give a good selection of information on the physical features and setting of the county, its towns and cities, geology and mineral resources, climate and ground water, soils and the relation of these features to agriculture and settlement.

The final chapter deals with the origin of local names. The text is embellished by several half-tone illustrations, one of which is an exceptionally fine two-page view showing foothills, bench land and bottom land, the locality of which is unfortunately omitted. The outline map of the county, supplied from the state capital, would be much improved if redrawn on a larger scale and reduced so that the lines and the lettering should be finer and clearer; the name of Musselshell River should be added along the eastern border. The bibliography at the beginning and the index at the end of the bulletin add much to its value.

Fergus County fully deserves not only three but a whole series of bulletins, for its area is almost as great as that of Massachusetts. It occupies the southwestern angle between the Missouri and Musselshell Rivers, and includes on its southwestern border parts of the Little Belt and Big Snowy Mountains of anticlinal structure, marginal members of the Rocky Mountain system. Near the county center the Judith and Moccasin mountains are residual masses maintained on igneous sheets and dikes in the higher members of the horizontal Plains strata; but the greatest part of the county lies in the Great Plains province. It offers an excellent field for geographical and geological exposition. As a general comment on the method of presentation employed, in so far as geography is concerned, it may be noted that the connection existing between various related facts is, by reason of their separate mention in different chapters, too often less explicitly brought out than is desirable as a means of introducing the "causal notion" into the popular conception of geography. For example, the second chapter on towns and cities is almost wholly empirical in its descriptions; again, the paragraphs on caves, which are described under "picturesque features" with a disproportionate amount of space given to ice caverns, do not sufficiently emphasize the control of their distribution by the tilted outcrops of the heavy mountain limestones. The penultimate chapter on geographical influences and consequences stands too far removed from the earlier accounts of physical features. The chapter on climate would be much improved if vivid explanatory descriptions of different types of weather were added to the text and tables in which the average values of climatic elements are presented.

On the other hand, by searching through the various chapters more information will be found concerning the origin of surface forms than is usually to be discovered in popular scientific essays. Properly enough, in view of the object of the bulletin, greater space is alloted to the nonapparent facts of geology, such as the great series of stratified formations from Cambrian to Tertiary, than to the manifest facts of geography, in spite of the first place given to this subject in the bulletin title; but geographers must be grateful for the intelligence with which many topics of their science are handled.

The reviewer heartily joins the author in wishing "to commend the long-sighted vision and the broadmindedness of the Board of Trustees in their efforts to disseminate local information." May their good example be widely followed!

W. M. Davis

An English County Geography

W. W. Watts. **Shropshire: The Geography of the County.** x and 254 pp.; maps diagrs., ills. Wilding & Son, Ltd., Shrewsbury, England, 1916. 2s 6d. 7 x 5 inches.

Had this attractive little volume been given the subtitle of "A General Description of the County" and published as one of a series of "County Handbooks," instead of as one of a series of "County Geographies," those interested in the progress of geographical science would not need to concern themselves particularly with its contents or its method of treatment; for all sorts of topics would have been properly included under a general title. But when all sorts of topics are gathered under the title "Geography" and presented in a manner that too frequently omits the essential characteristics of good geographical treatment by failing to point out the connection between event and environment, geographers must express their regret at the misunderstanding of their subject that will result, all the more because the author of the book is a scientist of high standing, whose opinion as to what constitutes geography will be accepted as authoritative by most readers.

The method of the book may be illustrated by two of its chapters. The first includes a section on physical features, under which the relief of the shire is described for the most part empirically, following a method that is going out of fashion even for popular handbooks. The following section treats the geological history of the underlying formations rationally, although with attention chiefly directed to depositional history and with insufficient consideration of erosional history, which in a geographical handbook is surely of equal importance.

The longest chapter of the book attempts to deal with "Historical Geography" and indeed presents much information on races and population, place names, written history, prehistory and antiquities, buildings and architecture, and great Salopians. All of this chapter is replete with interesting details, but it might have been just as well or better called county history, for it follows the order of time, not of place; and it too frequently omits all indication of a causal connection between occurrences and places, by which alone a truly geographical flavor can be given.

The really significant feature of this little book as a "County Geography" is that it represents the prevalent British idea of what a county geography ought to be; that is, a vaguely defined mixture of geology and history. Now that a "geographical tripos" and "honors in geography" have been established in at least one of the leading Universities of England, we shall look to the professors of geography there and to their students to redeem their subject from the status of a sort of hybrid learning and to develop it for itself just as geology and history are so worthily developed.

W. M. Davis

The British Fishing Industry

Neal Green. **Fisheries of the North Sea.** 178 pp.; map, ills. Methuen & Co., Ltd., London, 1918. $7\frac{1}{2}$ x 5 inches.

A small, informing, and authoritative book on these fisheries, with final chapters on fishing ports and the migration of fish, and a brief notice of the industry in North American waters. The author wastes no words and covers much ground in small space. Among other things he points out that Britain does not import fish from any country under foreign flags for the reason that she is in the center of the greatest fishing grounds in the world; and these banks often provide ten times as much food per acre as does the same area of good land. The world, he says, has 10,000,000 square miles of shallow waters where fish thrive; and should now make the most of the food, oils, and other products that fish supply. Of all the British food industries, the fisheries have received the least permanent damage by the war. The quantity of fish landed during the war was only about thirty per cent of normal, but the annual landings may now be vastly enlarged. The concluding pages are given to the chief British fishing grounds near home and the consideration of what should be done for their further development.

Cyrus C. Adams

Tree Growth and Climate

A. E. Douglass. **Climatic Cycles and Tree-Growth: A Study of the Annual Rings of Trees in Relation to Climate and Solar Activity.** 127 pp.; diagrs., ills., bibliogr. *Carnegie Instn. Publ. No. 289.* Washington, D. C., 1919. 10 x 7 inches.

In 1901 Professor Douglass began a study of tree growth which bids fair to be one of the most fruitful sources of information as to climate. His method, which is already widely known, consists of measuring the width of the annual rings of growth and thereby determining the climatic conditions. Beginning with the pine trees near Flagstaff Observatory in Arizona, where he was then at work, he has carried his observations to the Pacific and to the Atlantic coasts, and to many countries of Europe.

In the present volume Professor Douglass sums up all his work to date (compare the abstract on p. 190 of this *Review*). He rightly devotes much space to a careful description of the methods which he has gradually evolved. How delicate those methods are may be judged from his ability to identify rings of growth. Even if he knows nothing as to the date of a piece of wood he can assign each ring to its proper year, provided he knows where the tree grew and has other trees of known age and the same species with which to compare it. He does this by a minute study of the relative thickness and general characteristics of adjacent groups of rings. It seems almost incredible that such high accuracy is possible, but there can be no doubt that the method is successful. In this way he has checked up the reviewer's long series of measurements of the sequoias in California and has found that in spite of minor errors the general curve of climatic pulsations derived from a study of the big trees is correct.

Other parts of Professor Douglass' book are devoted to the correlation of the tree curves with the rainfall and with sun spots, and to a study of cycles. In addition, an important section describes methods of "periodic analysis." By the means of a periodograph of his own invention the author is able to analyze any sort of curve and find what periodicities it shows. This is done by photographing the plotted curve through a fine grating. If there is no periodicity the photograph assumes a hazy or dotted appearance. If there are periodicities, a series of parallel lines appears.

The chief results of Professor Douglass' work may be summed up as follows:

(1) He has developed a unique method and a highly perfect technique for the study of tree growth.

(2) He has shown conclusively that there is a close relation between the thickness of the rings of growth and the climate. This relation varies greatly from region to region, but the relationship can readily be worked out if sufficient data are at hand.

(3) He has shown that the tree records covering centuries agree with meteorological records covering decades in showing that the rainfall of different regions varies in opposite directions. This may happen even when places are only a few hundred miles apart, as on the eastern and western sides of the Scandinavian Peninsula.

(4) Professor Douglass has also shown that many of the curves of tree growth show a distinct correlation with changes in the number of sun spots. This is particularly marked in central and northwestern Europe.

(5) He finds a great number of cycles which he tabulates as follows:

5 to	6	years,	approximate	half	sunspot	period
10 "	13	"	"	full	"	"
21 "	24	"	"	double	"	"
32 "	35	"	"	triple	"	"
100 "	105	"	"	triple-triple	"	"

The chief criticism of Professor Douglass' work is that he perhaps overestimates the regularity of cycles. There can be no question as to the existence of cycles and as to their importance. To the reviewer, however, the cycles seem to be so irregular that it may be doubtful whether we are justified in assigning any exact periodicity.

Ellsworth Huntington

The Official Year Book of Australia

G. H. Knibbs. **Official Year Book of the Commonwealth of Australia, Containing Authoritative Statistics for the Period 1901-1918 and Corrected Statistics for the Period 1788 to 1900. No. 12, 1919.** xxxviii and 1234 pp.; maps, diagrs., index. Commonwealth Bureau of Census and Statistics, Melbourne, 1919. 9½ x 6½ inches.

The practice of the Commonwealth governments of Australia and New Zealand of publishing official yearbooks in which the current results of a number of government bureaus are recorded gives these publications a special value to the investigator. In the case of Australia the Bureau of Census and Statistics is the coördinating agency. In its latest publication, that for 1919, statistics for the period 1788–1900 are revised and those since 1900 are brought down, in authoritative form, to include 1918. Thus there is a complete statement of Australia's activities in the war and a statistical summary, graphically illustrated, of the relative cost of food, groceries, and house rent in relation to distribution of population for the years 1913 to 1918 inclusive. The latest irrigation developments are treated in detail. In fact, practically every aspect of Australian life in which a geographer might be interested is described or analyzed or illustrated by statistics or graphs. It may be noted in passing that the American Geographical Society has for several years given considerable attention to completing its collection of yearbooks owing to the growing value of many of them in scientific research.

The Australian yearbook for 1919 contains an orographical map of the Commonwealth that deserves special mention. Since 1903 the Weather Bureau has been collecting appropriate data for the map, and these have now been assembled and supplemented, and the contours redrawn, by Dr. Griffith Taylor, Commonwealth Physiographer and now also Professor of Geography at Sydney University. For much of the area the contours are only form lines sketched between stations of known height. For the rest the contours represent surveys of moderate detail. The result is that we have a general assembly of most diverse data but the whole so critically treated according to accepted cartographical principles as to make a real contribution to knowledge.

The map is in eight altitude tints separated by 0, 500, 1,000, 2,000, 3,000, 4,000, and 5,000 feet; and there is a separate shading for the land below sea level principally on the eastern and southern margins of the Lake Eyre depression, the surface of the lake being 39 feet below sea level.

This number of the yearbook also includes a specially contributed article, "The Plains and Peneplains of Australia," by E. C. Andrews.

A Centennial of American Science

E. S. Dana and Others. Edits. **A Century of Science in America, with Special Reference to the American Journal of Science, 1818–1918.** (Mrs. Hepsa Ely Silliman Memorial Lectures, Vol. 14.) 458 pp.; diagrs., ills., bibliogrs. Yale Univ. Press, New Haven, 1918. $4. 9 x 6 inches.

Among the thirteen chapters in this book, Chapter 3, written by Professor H. E. Gregory, of Yale University, is of interest to geographical students as a brief history of progress in the interpretation of land forms. In addition to many valuable sidelights on the history of the development of physiographical thought the chapter contains a useful bibliography of seventy-three titles, covering nearly all phases of the science.

THE GEOGRAPHICAL REVIEW

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The Society is not responsible for the opinions or the statements of writers in the Review

Published monthly by the American Geographical Society
Broadway at 156th Street, New York, N. Y.

Price, fifty cents a number
Five dollars a year

Entered as second-class matter, January 22, 1916, at the Post Office at New York, N. Y., under the Act of August 24, 1912
Acceptance for mailing at special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized on July 30, 1918

OUR CONTRIBUTORS

M. Guillaume Grandidier is secretary of the Société de Géographie de Paris and editor of its journal, *La Géographie*. The chief field of his work is Madagascar. He has made important contributions to our knowledge of the natural history, history and geography of the island. These include "Madagascar au XIXe siècle: Géographie, Ethnographie et Zoologie," 1902; "Bibliographie de Madagascar," 1905; "Collection des ouvrages anciens concernant Madagascar" (in collaboration with M. Alfred Grandidier), 1903–1908; "Ethnographie de Madagascar" (in collaboration with M. Alfred Grandidier), 1908–.

Captain Aurousseau is lecturer in geology in the University of Western Australia, Perth. During the war he served with the Australian Infantry on the French front. Observations made at this time form the basis of the article here published. Another outcome of Captain Aurousseau's experience is "An Outline of the Geology of Entre Sambre et Meuse," Australian Corps, Belgium, 1919.

Dr. Ruthven is Director of the Museum of Zoology and Professor of Zoology in the University of Michigan. His researches have been in the fields of herpetology and zoögeography, and more specifically upon the geographic factors which influence the distribution of animals. Much of his field work has been done in South America. During the past summer he conducted an expedition to the Sierra Nevada de Santa Marta, exploring the east and south sides of the range from Riohacha to Fundacion. It is expected that this field work will complete the survey of the mountains which the University of Michigan has had in progress for seven years.

Professor Davis is the leading exponent of physiography, or the rational study of land forms; to his teachings is mainly due the universal recognition of America's preeminence in this science. Among his numerous writings may be mentioned "Physical Geography" (1898); "Geographical Essays" (1909); "Die erklärende Beschreibung der Landformen" (1912) written while exchange professor at the University of Berlin in 1908–09. In 1911–12 he was visiting professor at the University of Paris. In the latter year he conducted the American Geographical Society's International Transcontinental Excursion across the United States. Professor Davis is Sturgis-Hooper Professor of Geology, Emeritus, at Harvard University.

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Map of Eastern Labrador, by MRS. LEONIDAS HUBBARD, Jr. 1:1,584,000. 1906. Embodies original survey of the George and Nascaupee Rivers across eastern Labrador from Ungava Bay to the Atlantic.

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Mercator's Map of the World, 1538. Facsimile in black-and-white, reproduced from the original in the Society's collection (only two original copies of this map are known). 1885.

THE
GEOGRAPHICAL REVIEW

VOL. X OCTOBER, 1920 NO. 4

MADAGASCAR

By GUILLAUME GRANDIDIER
Secretary of the Geographical Society of Paris

Madagascar, situated to the southeast of Africa, appears at first glance to form a dependency of that continent, whence the name Great African Island by which it is not infrequently known. But the designation conveys an erroneous idea, for this new colony of France is a little continent in itself, isolated from the rest of the world and preserving in its isolation relics of a vanished geological age. Its soil, animals, plants, peoples all have a distinguishing characteristic: they are Malagasy. In a word, Madagascar is biologically an entity—a whole on which a complete monograph might be written without reference to neighboring regions save by way of comparison. And this constitutes not the least of the charms that make the island so alluring a subject of study.

THREE MAJOR NATURAL REGIONS

Madagascar, covering an area of 228,000 square miles, is somewhat larger than France. The island exhibits a very diversified relief. The eastern and central portions comprise granitic terrains, the western coastal region is predominantly calcareous. The culminating elevations of the island, nearly 3,000 meters (over 9,000 feet), are found in the extinct volcanoes of the north and center. The distance between the most northerly point (Cape Amber, latitude 12° S.) and the southern extremity (Cape St. Mary) being approximately 1,000 miles, the island belongs as regards climate in part to the tropical, in part to the temperate zone. Hence it is not surprising to find in Madagascar a variety of regions quite distinct in regard to the flora and fauna and in the mode of life of their inhabitants.

Three major natural regions may be recognized: the Central Massif, or Central Plateau; the Eastern Coast Chain, which descends more or less abruptly to the Indian Ocean; and the Plains region of the south and west, sloping gently to the shores of the Mozambique Channel.

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THE CENTRAL PLATEAU

The Central Plateau, as it is commonly called, occupies about one-quarter of the island and includes the regions of Imerina and Betsileo in their entirety. It is a chaotic mountain mass having a mean altitude of 1,200 meters. The recent eruptive material excepted, it is formed of primitive rocks, in part exposed, in part covered with the product of decomposition—the red argillaceous earth known as laterite. Because of its deficiency in plant food the red earth forms a poor soil from the agronomic point of view. Furthermore, the region is very arid, and cultivation succeeds only in the depressions naturally humid or irrigated from the watercourses.

But on the other hand the climate is good. The temperature is agreeable to Europeans.[1] Malarial sickness is rare and where it exists is seldom of a grave nature. This is the most populous region. The immigrant Malays, progenitors of the Hova, shunning the unhealthful districts of the eastern coast, sought refuge here. Here are the largest towns, such centers as Antananarivo and Fianarantsoa. Here Europeans can both live and work.

THE EASTERN COAST CHAIN

The Central Plateau of Madagascar extends over a little less than half the breadth of the island. The long coastal chain which separates it from the Indian Ocean occupies only one-fifth, having a width of some 80 kilometers. This chain, the second of our regions, has a north-northeast to south-southwest orientation closely bordering the shore from which it rises by successive steps to an altitude of 1,000 to 1,500 meters. A sandy zone more or less broad gives place to hilly ground, 20 to 50 meters high and characterized by a special type of vegetation which includes the traveler's-tree (*Ravenala madagascariensis*): the vacoa (*Pandanus utilis*); and the raffia (*Raphia ruffia*), the palm whose graceful fronds furnish fiber for rope weaving.

Above these low hills commence the mountains proper. The climate is warm, moist, equable, and favorable to the growth of a luxuriant vegetation.[2] Patches of virgin forest still remain scattered over the entire eastern slope, though much destruction has been wrought by the native cultivators who have burned over extensive areas. Just under the summit, however, there stretches along the entire length of the island a continuous band of magnificent forest abounding in valuable plants, in tree ferns and orchids.

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[1] The average annual temperature of Antananarivo (1400 m.) is 62° F., the extreme months being February, 67° F., and July, 55° F. (Julius Hann: Handbuch der Klimatologie, 3 vols., Stuttgart, 1910; reference in Vol. 2, p. 130.)

[2] The mean annual temperature of Tamatave, on the eastern coast, is 74° F., the extreme months being February, 80° F., and July, 68° F. The mean yearly rainfall is 115 inches.

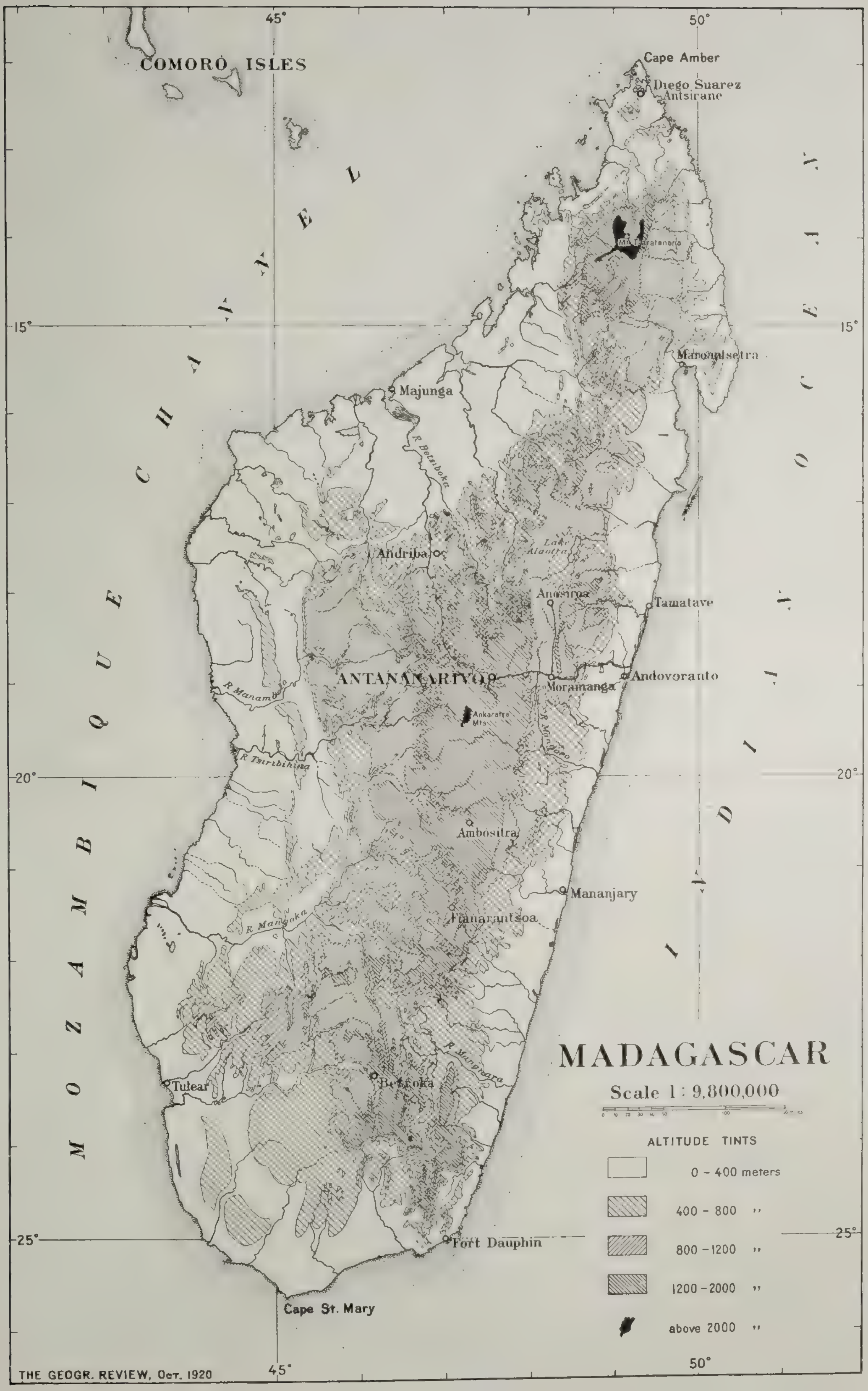

FIG. 1—Relief map of Madagascar. Based on Carte hypsométrique de Madagascar, by E. F. Gautier, 1902

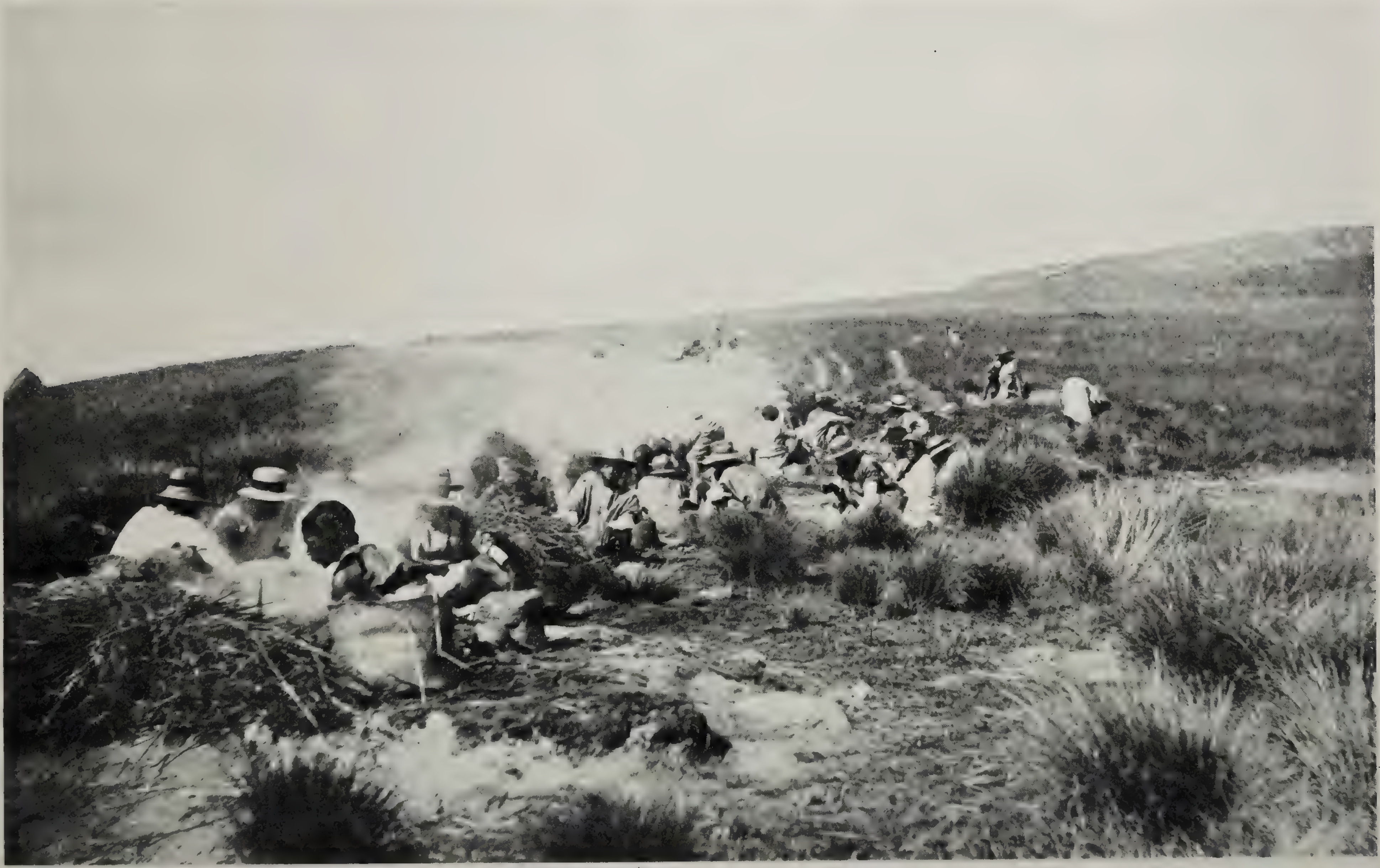

FIG. 2—Porters stopping for a meal by the roadside. A typical landscape in Imerina—rolling moorlike hills covered with short grass.

THE WESTERN PLAINS

The western region differs completely from those of the center and the east. In place of a chaos of mountains whose compact red soil supports either a verdant vegetation as in the east (where is a layer of humus, at once the product and in part the cause of the vegetation) or a meager growth of scant grass as in the center, here in the west are plains, gently rolling, calcareous or sandy, clothed in tall grass with palm forests and clumps of woodland. This is a region adapted to grazing, and herds of cattle are numerous.

The southern region presents the similar aspect of a slightly diversified plain, except in the eastern part which is broken by tolerably high hills. The south, however, is characterized by very great aridity, especially in the territories occupied by the little tribes known as the Antandroy and Mahafaly. In the vicinity of Cape St. Mary, for example, the numerous inhabitants are dependent on rain water as their sole source of supply, and sometimes rain falls only at intervals of many months. In this part of Madagascar all forms of life, the plants in particular, are adapted to a condition of drought, and in consequence the country wears a strange aspect comparable only to certain desert sections of Mexico and Central Africa.

The People: Their Distribution and Origin

The population of Madagascar is very unequally distributed, and the density is low. Although no exact census has been taken outside of the provinces of Imerina and Betsileo the total population of the island may be estimated at 3,500,000,[3] less than one-tenth the population of France. Of the total number the inhabitants of the Central Plateau, the Hova and the Betsileo, account for more than 1,000,000, and those of the eastern coast region for about 400,000.[4]

Today the people of Madagascar are collectively known as Malagasy, a name of foreign origin and comparatively recent introduction. Originally the islanders were divided into an infinity of little tribes, or one might rather say clans, absolutely independent of one another, each obedient only to its own chief. Connection between them was limited to frequent and reciprocal raiding for cattle and slaves. It was not until after the arrival of successive bands of immigrant peoples—Arabs, Indians, Malays, and Europeans—that the independent clans began to group themselves into larger bodies. The tendency towards grouping, however, has progressed apace especially since the eighteenth century, and there have thus been constituted the 17 principal peoples or tribes as they exist

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[3] The official estimate for 1918 is 3,545,575 according to the figures quoted in *Suppl. to Commerce Repts.*, Ann. Series, 1920, No. 72 b, p. 10.—EDIT. NOTE.

[4] According to Lieut. Éd. de Martonne (La densité de la population à Madagascar, *Ann. de Géogr.*, Vol. 20, 1911, pp. 77–85; map) seven-tenths of the colony has a population of less than 12 to the square mile; one-tenth only has a population of over 25 to the square mile.

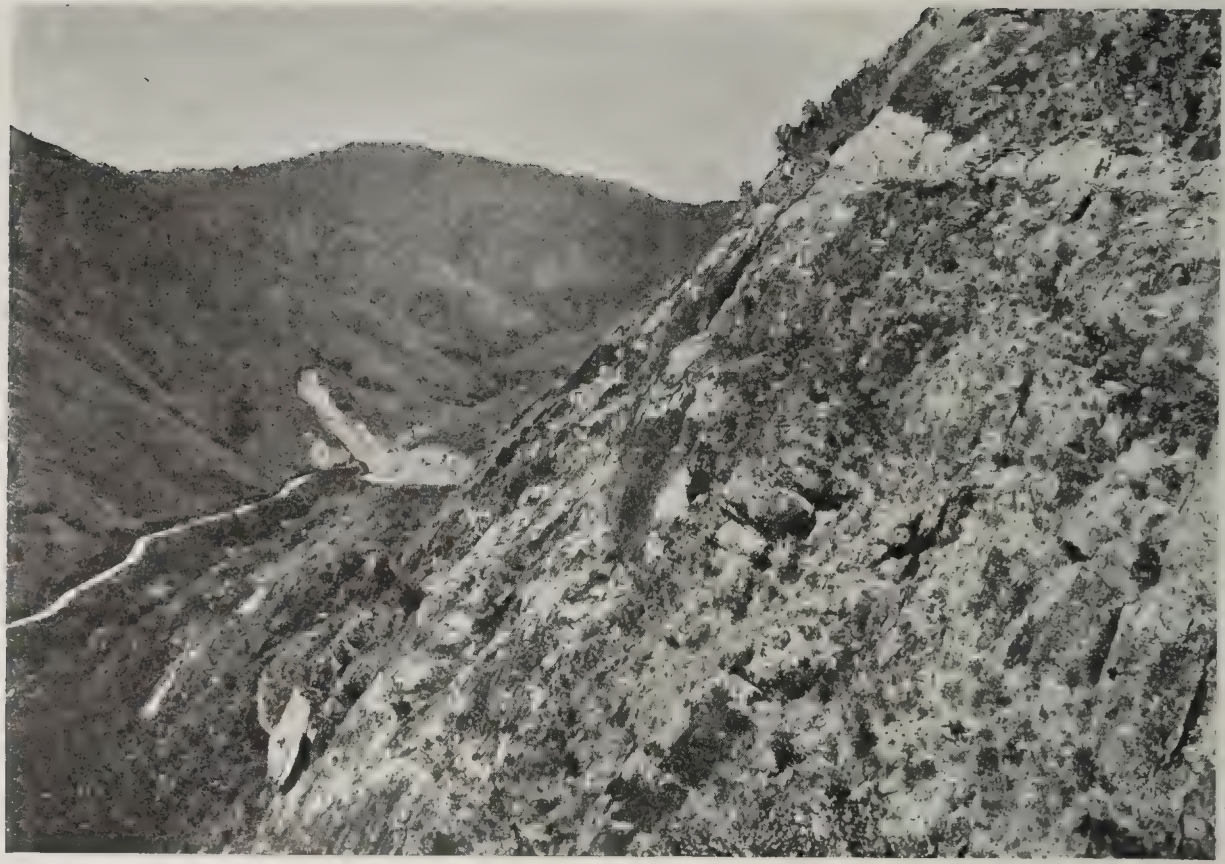

FIG. 3

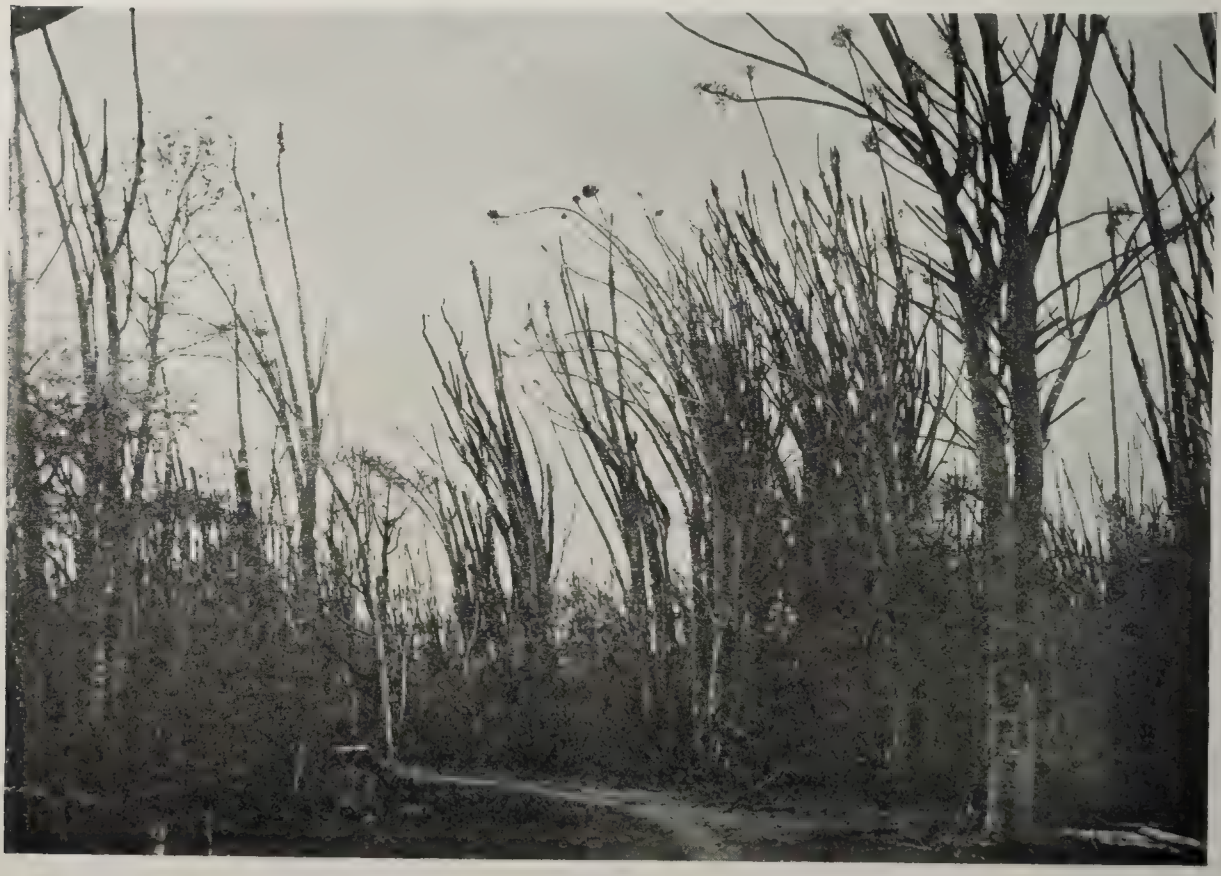

FIG. 4

FIG. 3—On the road from Tamatave to Antananarivo: crossing the eastern wall of the central plateau by the pass of Angavo.

FIG. 4—Road through the spiny bush of Androy ("country of spines"), southern Madagascar. The vegetation of this subdesertic region is in complete contrast with that of the rest of the island.

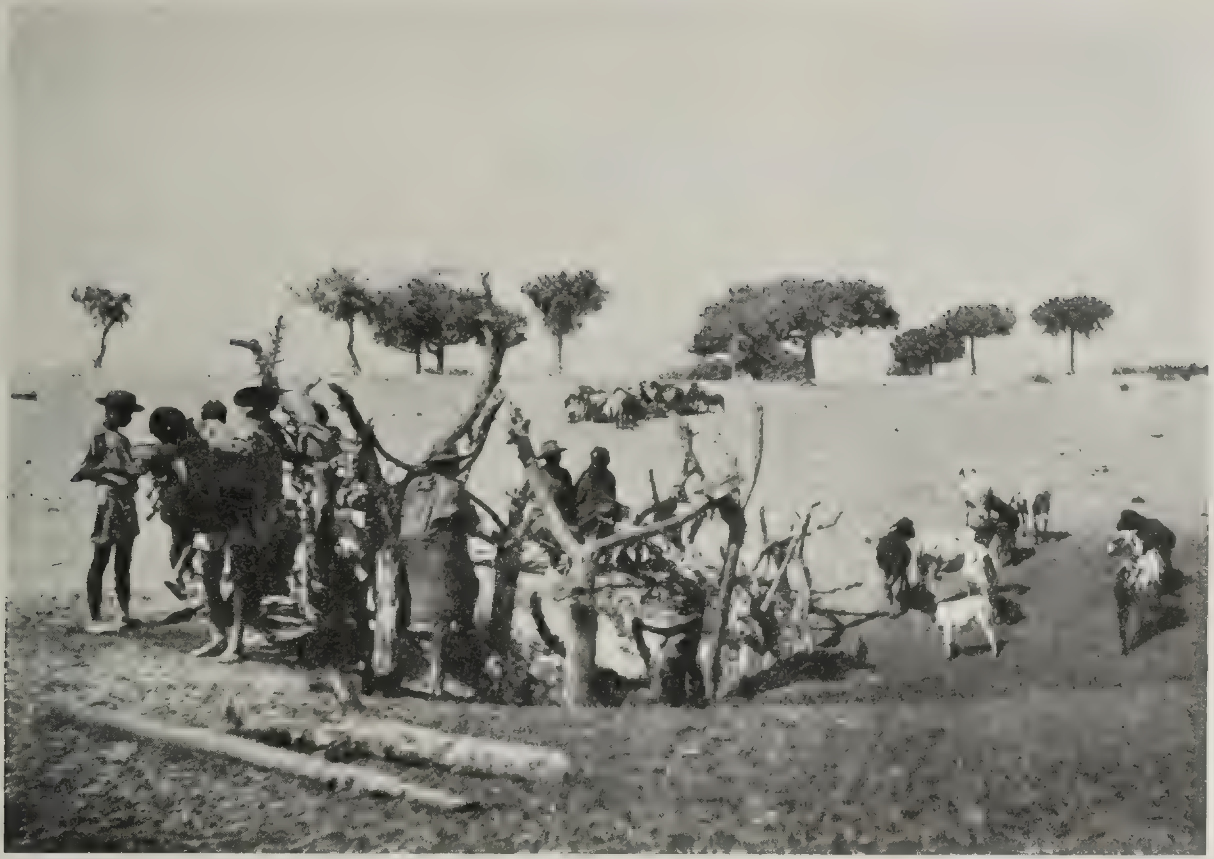

FIG. 5

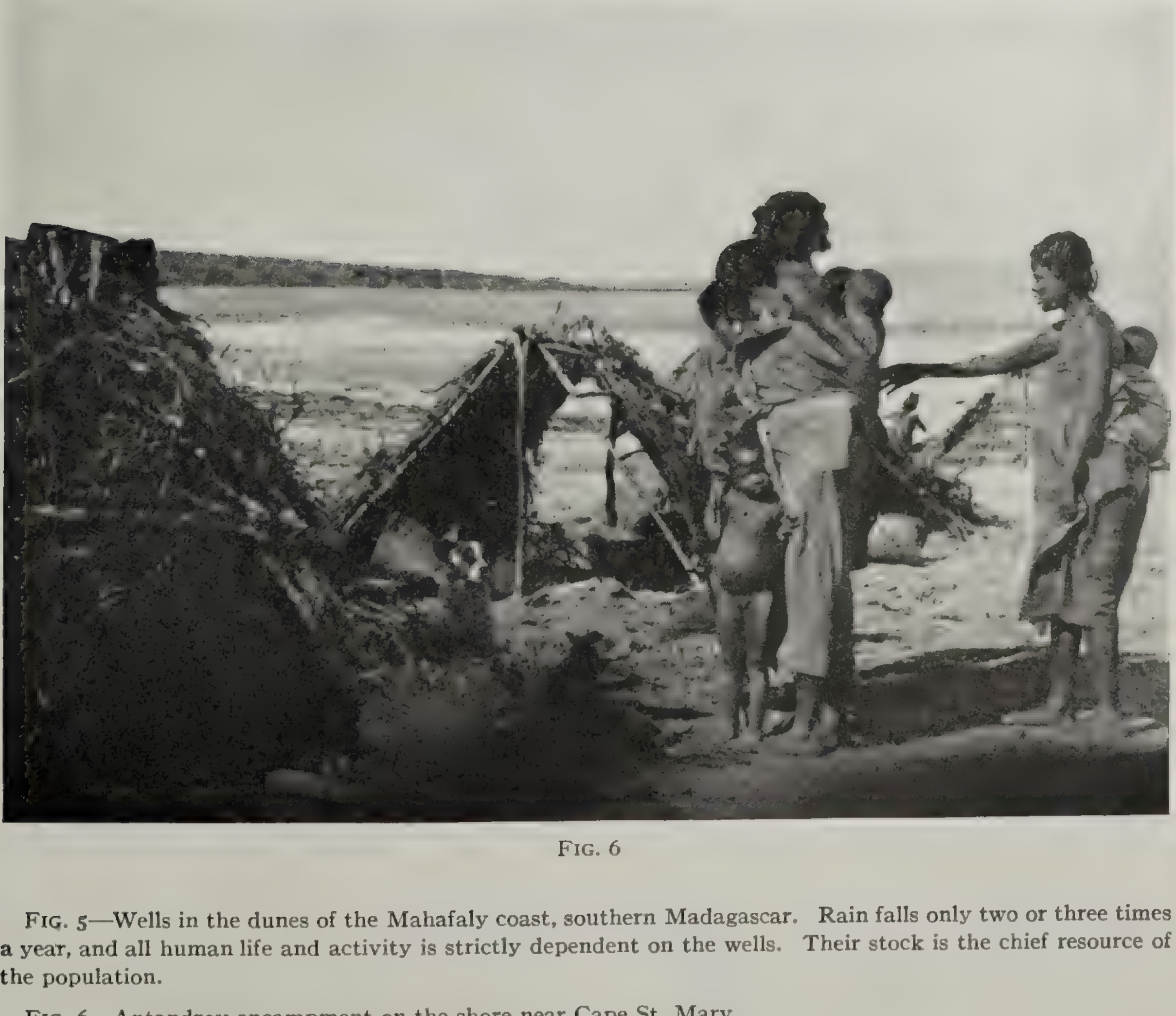

FIG. 6

FIG. 5—Wells in the dunes of the Mahafaly coast, southern Madagascar. Rain falls only two or three times a year, and all human life and activity is strictly dependent on the wells. Their stock is the chief resource of the population.

FIG. 6—Antandroy encampment on the shore near Cape St. Mary.

today. Of these the most important are the Hova, Betsileo, and Bara occupying the center of the island; the Antankarana in the north; the Betsimisaraka, Betanimena, and Antimorona in the east; the Antanosy, Antandroy, and Mahafaly in the south; and the Sakalava in the west.

THE MERINA OR HOVA

Amongst the divers tribes one proved itself more intelligent, better disciplined, and more powerful than the others so that it eventually succeeded in establishing effective dominion over more than half the island, while by a system of posts or skillfully distributed forts the other half was kept in check. Furthermore, for a century this tribe maintained a determined resistance to both French and English influence, playing off the one against the other, determined to yield to neither. This is the people known as Hova. They occupy the center of the island, Imerina, and have their capital at Antananarivo.

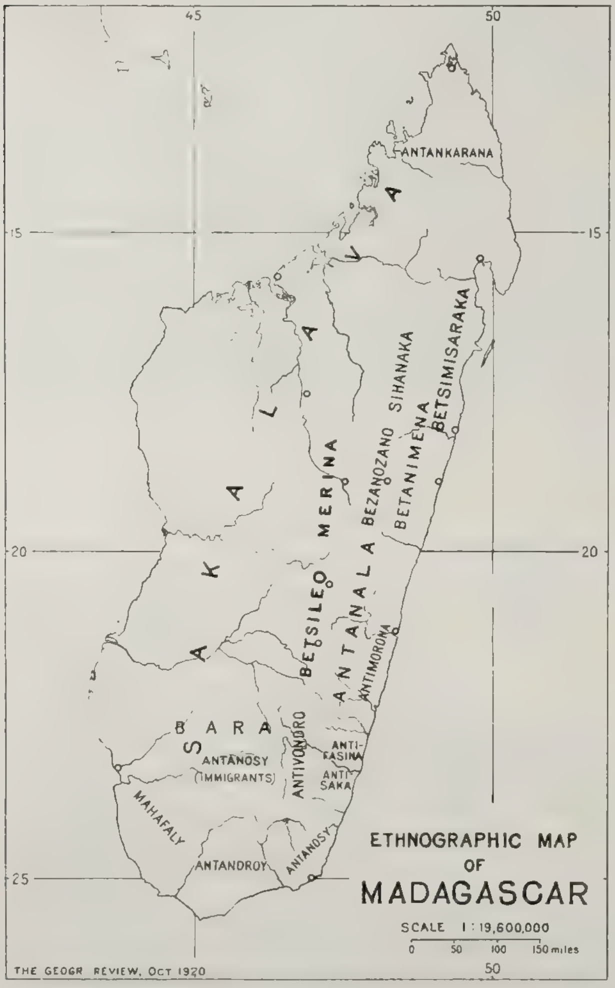

FIG. 7—Ethnographic map of Madagascar. The principal Malagasy tribes are shown. For details of distribution see: Alfred and Guillaume Grandidier: Histoire physique, naturelle et politique de Madagascar, Ethnographie, Vol. 1.

As a matter of fact the name Hova as applied in this sense to the population of the central plateau is erroneous. The Hova are only one of the three castes composing the Merina—the *Andriana*, or nobles; the *Hova*, or free men; the *Andevo*, or slaves. But this usage has prevailed, and hereafter we shall employ Hova to designate the entire population of Imerina.

UNIFORMITY OF LANGUAGE AND CUSTOMS

The traveler in Madagascar is invariably struck by the uniformity of the native customs and especially by the unity of the language—surprising circumstances when one considers that until recently intertribal communication was limited to plunder and raid. Yet throughout the length and breadth of the island we find a single speech varying from place to place only in pronunciation and in the words of foreign origin introduced by immigrant peoples or substituted for others whose usage has been locally tabooed. This phenomenon has long been noted by sailors and travelers, who have further remarked the connection between the Malagasy tongue and Malayo-Polynesian dialects; but they failed to draw the conclusion, logical as it is, that the mass of the Malagasy have come from the Far East bringing their language with them. An explanation indeed had been sought in the supposition that the Andriana, who are generally known to be of Malay origin and who have imposed their authority on the Imerina and the neighboring regions, had at the same time imposed their language not only on these conquered peoples but also on all the other tribes of the island. On grounds that have already been suggested, and in the light of other facts, such an hypothesis is unacceptable.

MALAYO-POLYNESIAN AFFINITIES OF MALAGASY

Although the Malayo-Polynesian affinities of the Malagasy language[5] have been recognized since the discovery of the island the blood relationship of the people with the Oceanic negroes, which agrees as well in respect of their physical characteristics and culture as their language, had never been affirmed or even suspected until deduced by Alfred Grandidier from his travels of 1865–1870.[6] As a matter of fact all the Europeans who had been in touch with Malagasy peoples, other than the Andriana and the chiefs of the principal tribes, had been struck by the color of their skin which is very dark without being the fine ebony black of the Senegalese and Sudanese. They drew the conclusion that the bulk of the Malagasy were African negroes, overlooking the fact that in Asia and Oceania there exist black peoples ethnically far more closely related to the natives of Madagascar.

One of the chief reasons for the general acceptance of an African origin for the Malagasy lies in the geographical situation of the island. Africa is comparatively near, and it seems natural enough that this continent should have furnished the first occupants of Madagascar. On the contrary the island world of the East is at an enormous distance, insuperable for primitive peoples—or so it may seem to those unacquainted with the regimen of the winds and currents of the Indian Ocean and with the history and customs of the Indo-Melanesians. The negroes of the coast of Africa, who are very poor mariners, do not venture on the high seas, and, furthermore, the currents in the Mozambique Channel are unfavorable to west-to-east crossing. On the other hand the Indo-Melanesians are excellent navigators, and the equatorial currents of the Indian Ocean bear directly on Madagascar. Pumice stone from the famous Krakatoa has been found on the eastern shores of Madagascar and even further afield. It has, for instance, been reported from Port Elizabeth and mingled with it were seeds of *Barringtonia speciosa*. And historic examples are not wanting to show that man too can be carried westward by these currents.[7] At the beginning of the nineteenth century a Malay junk, caught by a storm off the Sunda Islands and carried westward, came to land at Tamatave.

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[5] As will be described later the Andriana are fairly pure-blood Malays whose forefathers arrived in Madagascar in the sixteenth century. The Malagasy language belongs to an early branch of the Malayo-Polynesian family.

[6] An appreciation of Alfred Grandidier's work on the ethnology of Madagascar may be found in the article "Madagascar," by W. H. Hunt, *Bull. Amer. Geogr. Soc.*, Vol. 32, 1900, pp. 297–307. For details of Madagascan ethnology see Alfred and Guillaume Grandidier: Ethnographie de Madagascar, 3 tomes, Paris, 1908, 1914, 1917 (constituting Volume 4 of "Histoire physique, naturelle et politique de Madagascar, publiée par A. et G. Grandidier," 59 vols., Paris, 1876–).

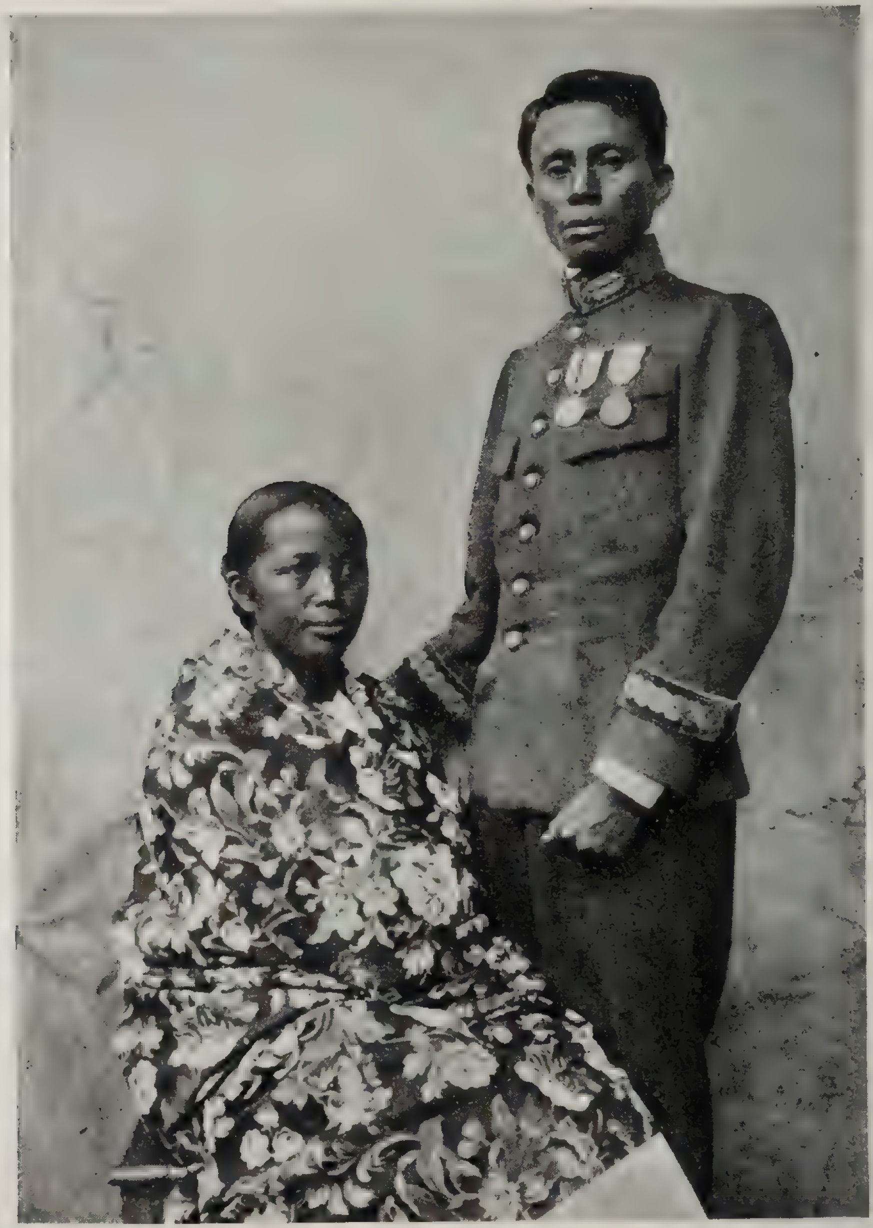

FIG. 8—A Hova functionary and his wife. The upper classes of the Hova, the *Andriana*, are comparatively pure-blood Malay.

THE QUESTION OF AN ABORIGINAL POPULATION

The question then arises as to whether the first Indo-Melanesian arrivals on Madagascar found the country empty or in the occupation of an aboriginal population. No certain answer can be given, but if the island was indeed peopled the occupants must have been few in number and in a low state of civilization for they have left no trace either in culture or language.[8]

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[7] The outrigger canoes of Madagascar and the east African coast are derived from two forms both originating in Java. James Hornell: Les piroques à balancier de Madagascar et de l'Afrique orientale, *La Géographie*, Vol. 34, 1920, pp. 1–23.—EDIT. NOTE.

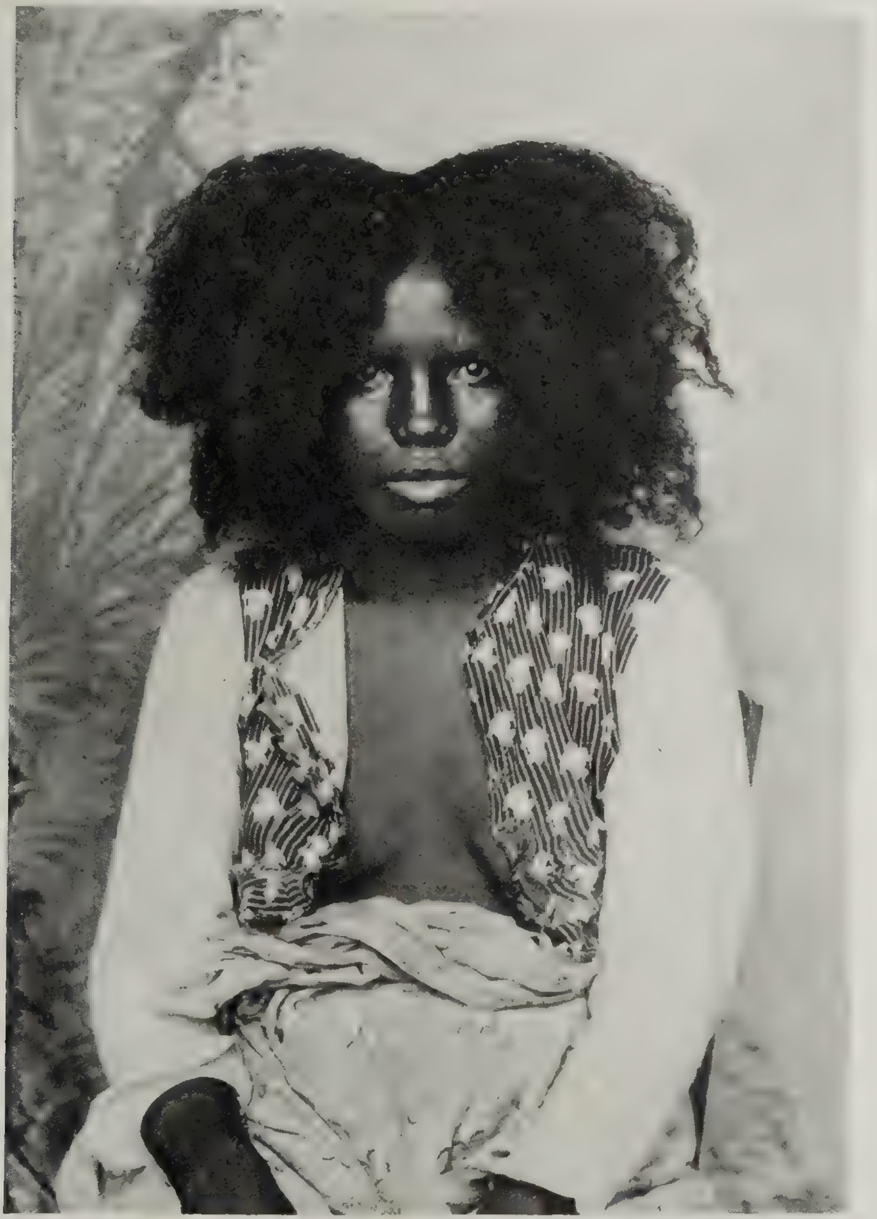

FIG. 9—Sakalava woman, hair loosened according to the custom in mourning. The Sakalava, occupying the western section of Madagascar, are one of the tribes descended from the early Indo-Melanesian immigrants who may be considered the basis of the Malagasy peoples.

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[8] In "The Bantu in Madagascar" (*Journ. African Soc.*, London, Vol. 19, 1920, pp. 305–316) Emil Birkeli claims the recognition in western Madagascar of two different racial groups "both belonging to a low Negro type." Birkeli spent several years among the Wazimba of the Tsiribihina and Manambolo Rivers and also carried his investigations among the Bausi of the highland fastnesses of Bemara. The former are described as "lake dwellers" showing connections with fishing tribes of African origin, the latter as "cave dwellers" exhibiting parallel features with the forest people of eastern and central Africa and with the Bushmen. From the Wazimba Birkeli collected "tribes' names and traditions, special religious customs, list of words for utensils and plates, names of persons and places, and fragments of songs and prayers; all in a 'foreign' language, incomprehensible to the people of today." Fragments of ancient language were also collected among the Bausi. In an accompanying note Sir H. H. Johnston states as a conclusion that "the present mainly Indonesian population of Madagascar were almost certainly preceded by a Negro race." How such a people reached Madagascar remains a problem.—EDIT. NOTE.

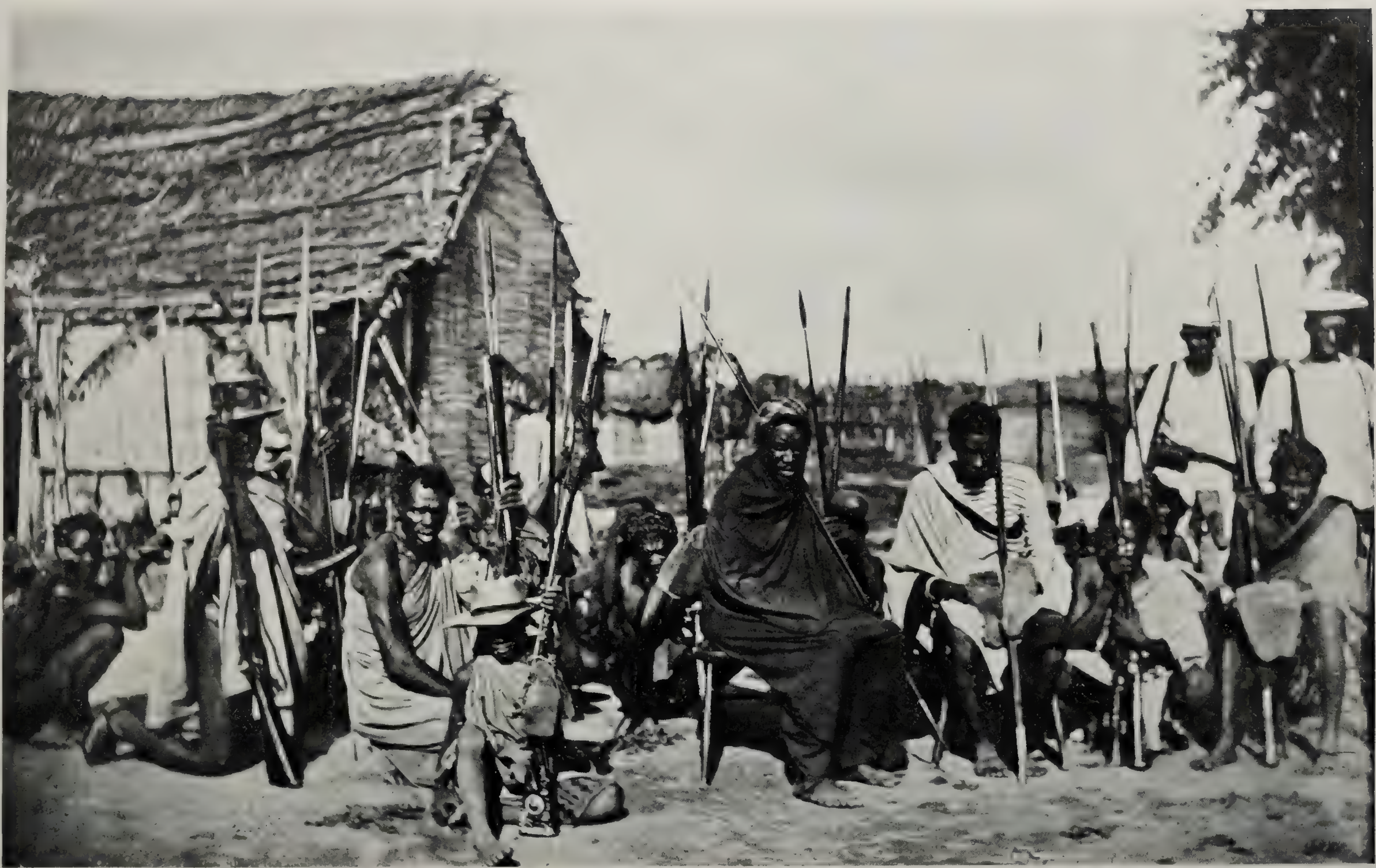

FIG. 10—The Bara King, Impoinimerina, and his court, Fiherenana, a district of southwestern Madagascar. The Bara are amongst the least civilized peoples of Madagascar. Spear and gun proclaim their warlike attributes.

The Indo-Melanesian element may then be considered the basis of the Malagasy population. To it has been added another eastern strain by the Malay immigration of the Middle Ages. There is no doubt that the Andriana, or nobles, of Imerina are of pure Malay race. Anthropological study proves this in the clearest manner. At first glance it is impossible to distinguish a pure-blood Andriana from a Javanese. Andriana who went to Paris for the World's Fair of 1900 were invariably referred to by the man in the street as Indians and never as negroes.

The Malay immigrants soon abandoned the eastern coast, driven out either by the occupants or the insalubrity of the climate. They sought refuge in the inhospitable region of the central plateau scantily peopled by Wazimba. Superior in intellect and ability they gradually rose to a position of dominance over the peoples among whom they settled. The story of their progress, of the foundation and development of the Hova state, is not without interest for it explains the history of the conquest of the island by France.

Development of the Hova State

Early in the seventeenth century the Hova State, though restricted in extent, appears to have been firmly established. Ralambo, the second king of the Hova dynasty, had conquered Antananarivo, and with the fertile basin in which it lies, one of the granaries of Madagascar, it became the center of the kingdom. Ralambo gave special attention to the extension here of rice cultivation, the staple of Malagasy existence. Andrianampoinimerina, with whom the historic period proper may be said to begin, augmented the kingdom by the subjugation of the Sihanaka and the Betsileo, thus obtaining definite mastery over the central region. These peoples, however, though conquered were not subdued; and from his ascent to the throne his son and successor Radama I (1810–1828) was called upon to suppress rebellions among the Bezanozano and Sihanaka who sought to regain their independence. More significant, however, was the turn taken by external affairs—the arrival of English agents who entered into competition with the old established French interests.

Contacts with European Civilization

Under Radama the Hova were definitely brought in touch with European civilization. The sovereign devoted himself in particular to the furthering of education, opening schools for the instruction of adults as well as children. He sent nine young Hova to England to learn the more important trades, and many English artisans, among them the carpenter Cameron, were brought into the country. A practical result was seen in the progress of bridge building. For himself he had built by a French carpenter, Legros, the pretty little palace Trano Vola ("silver house") and a country house at Soanierano, south of Antananarivo.

This taste for certain material products of European civilization was shared by Radama's successor Queen Ranavalona I, who erected the first great building in Madagascar, the Manjaka miadana ("reigning in peace and prosperity"), an imposing monument and the most striking feature of Antananarivo, today dominating the humbler brick and wooden structures perched on the hillsides of this picturesque and strategic site. Under Ranavalona, Hova power and prestige was greatly strengthened. Antananarivo itself, which had hardly 15,000 inhabitants in 1853, boasted a vastly larger population at this time swollen by the presence of a garrison of 12,000 soldiers—a measure of the military expansion needed to keep pace with the ever-widening frontiers.

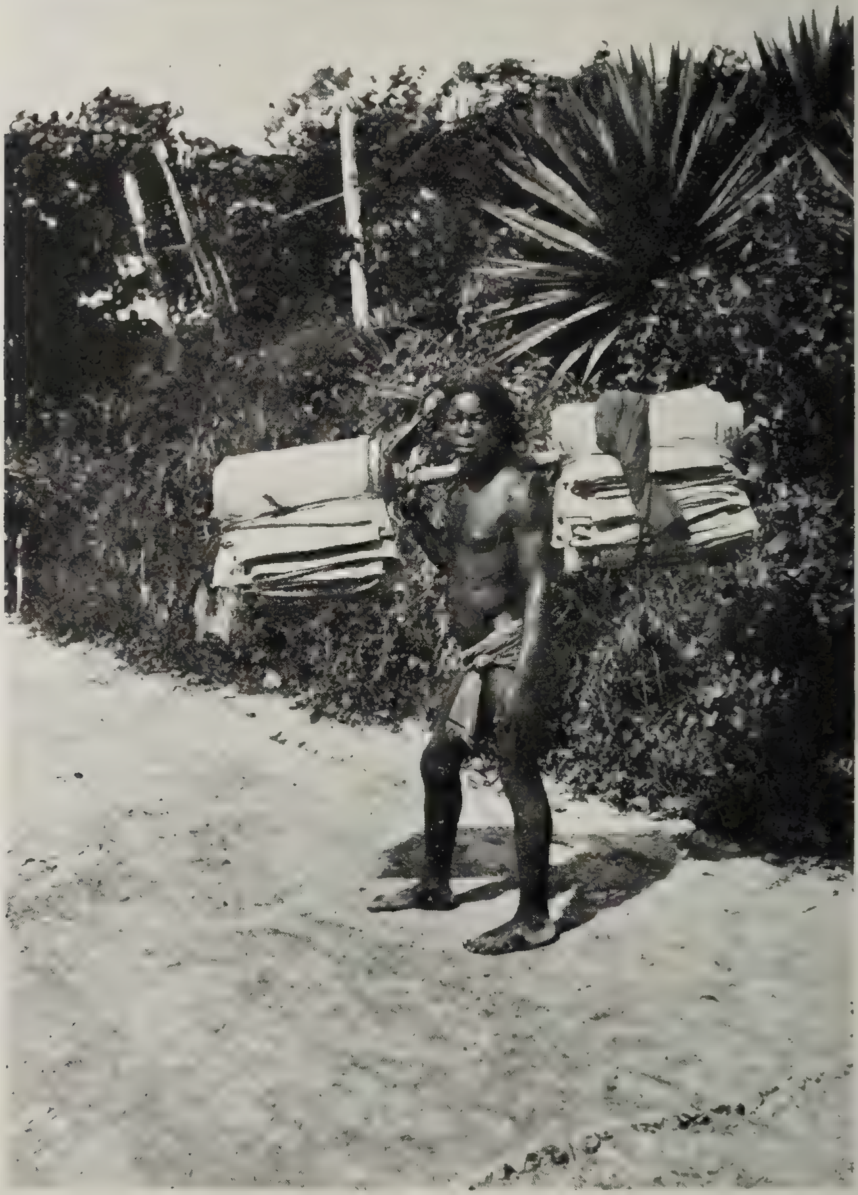

FIG. 11—A carrier of rush mats, eastern coast of Madagascar.

A Reactionary Queen

But in spiritual matters Ranavalona proved reactionary. In 1835 she began persecution of the Christians. Observances of the Christian church were forbidden, and penalty of death was proclaimed for those natives who professed Christianity, unless the "heresy" was renounced. Suspects were subjected to the ordeal of the *tanghin*, or poison ordeal.[9] The *mpivavaka*, the native priests, were driven from Imerina, and the English missionaries likewise were expelled. "Blood—and always blood—is the maxim of Queen Ranavola, and every day seems lost to this wicked woman on which she cannot sign at least half a dozen death warrants."[10] On the

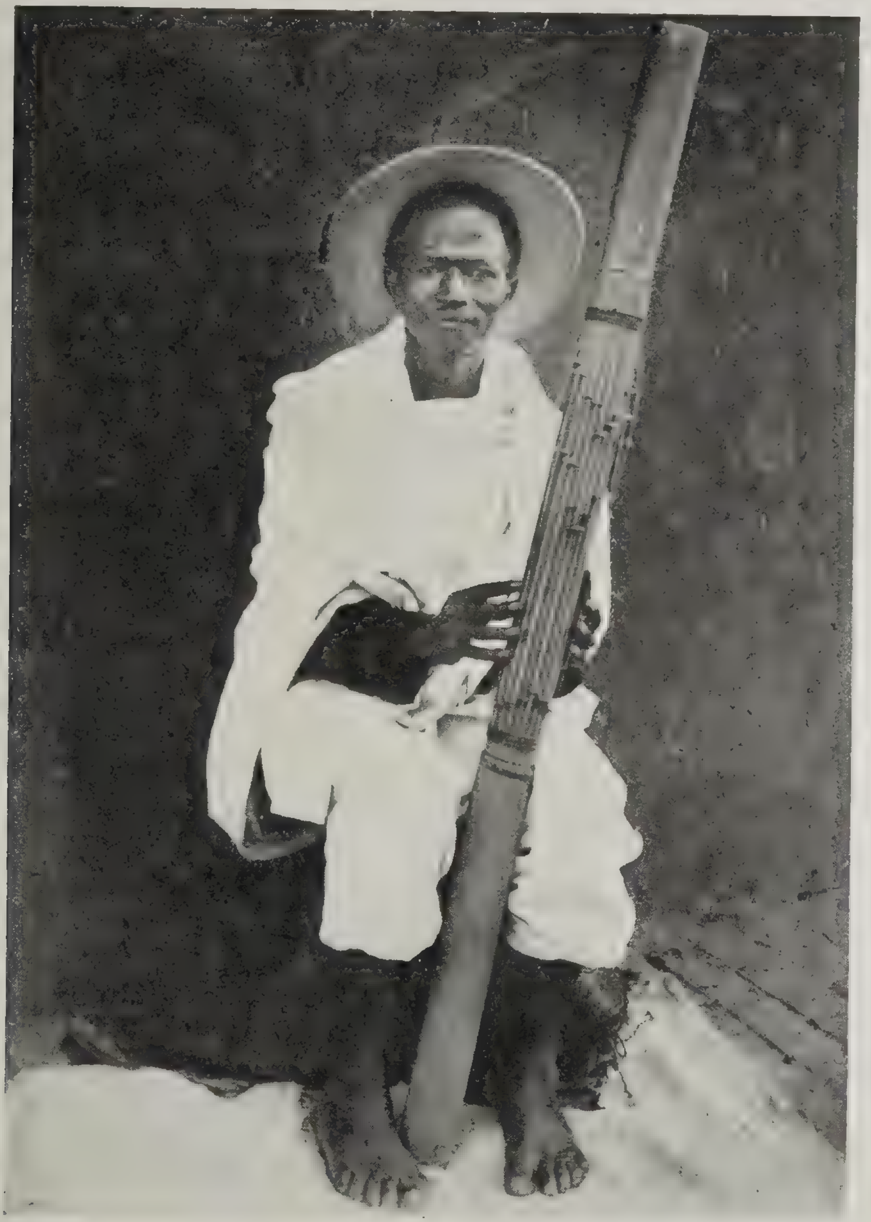

Fig. 12—Player of the *valiha*. This curious native guitar is made from the ultra-useful bamboo.

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[9] "The Tangéna is a small and handsome tree growing in the warmer parts of the island, and the poison is procured from the nut of its fruit" (James Sibree: The Great African Island: Chapters on Madagascar, London, 1880, p. 281).

[10] The Last Travels of Ida Pfeiffer, New York, 1861, p. 212.

succession of her son Radama II in 1861 this retrograde policy was abandoned. Radama was the friend and pupil of the Frenchman Laborde, a man of great energy and resource, who was shipwrecked on the island in 1831 and remained there, figuring prominently for half a century in Madagascan affairs. Radama invited Europeans to Madagascar and sanctioned measures for European colonization. He opened schools and encouraged the preaching of Christianity. Catholic and Protestant missionaries alike were welcomed and given permission to establish churches in Antananarivo, a liberal attitude that roused the hostility of a part of the old régime. At the same time Radama II wrecked the stability of his kingdom by his lapse into a life of pleasure and debauchery. Retiring to the famous Trano Vato ("stone house") he abandoned the country to the rule of favorites. Before long rebellion was provoked in which the King was killed.

Opposition to French Influence

His widow Rabodo was proclaimed Queen under the name of Rasoherina, but the effective rule was in the hands of the Prime Minister as in fact continued to be the case under subsequent queens. Rasoherina's first Prime Minister was strongly opposed to French influence. When in August, 1863, Commander Dupré arrived with the Franco-Malagasy treaty, which had been prepared by Radama II and signed by Emperor Napoleon III, he found the new Prime Minister set against ratification. This involved the charter of the Madagascar Company previously granted to the Frenchman Lambert who had arrived simultaneously with several engineers to engage in the enterprise which was of an industrial and commercial character. Later an indemnity of 1,200,000 francs was obtained for the breaking of the charter. As a result of the incident, however, bitter feeling was aroused, and even after the exile of this minister English influence remained in the ascendant.

A treaty with England was signed in 1865 while efforts were still in progress to make the proposed treaty with France an accomplished fact. Comte de Louvières, sent to take up negotiations, met with an unfavorable reception. On landing he found that an edict had been promulgated prohibiting the sale of lands to Europeans and that the Malagasy army had been ordered to be in readiness in the event of war. During the course of the protracted negotiations that ensued the French plenipotentiary died. Before his successor arrived a treaty was signed with America analogous to that with England; but at last, in 1868 shortly after Queen Rasoherina's death, signing of the French "Treaty of Peace and Commerce" was effected.

Towards the end of the reign of Rasoherina's successor, Ranavalona II, trouble between France and the Malagasy government became acute, the crisis in particular arising over the attitude of the Hova towards the Sakalava of the northwest over whom France claimed a protectorate. Military

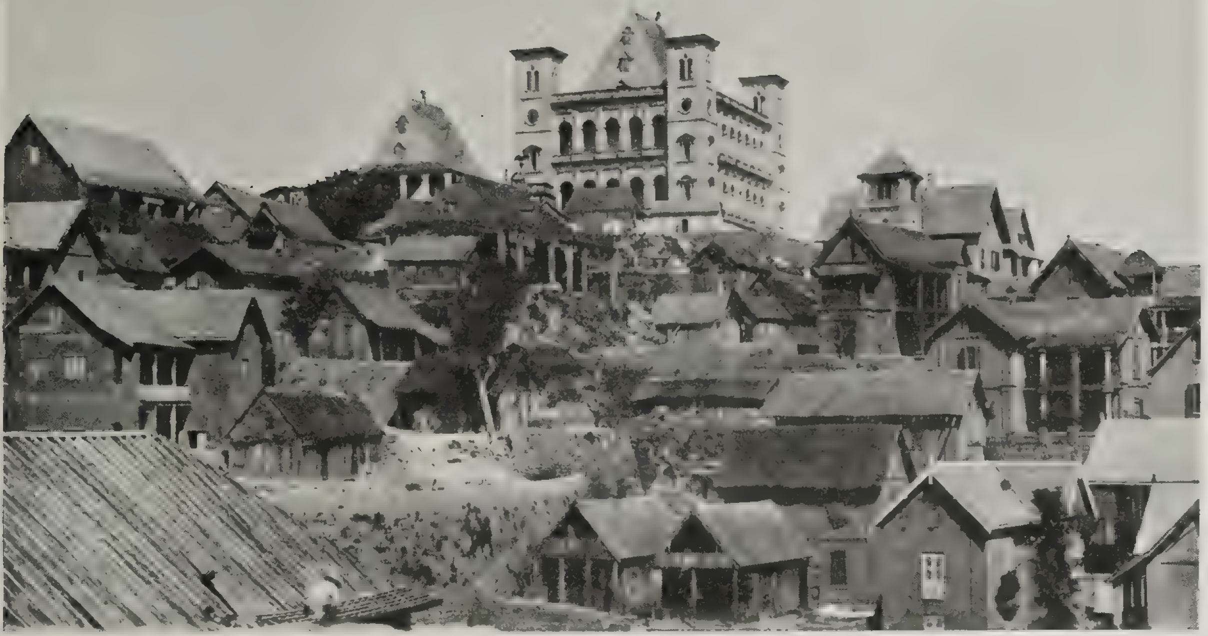

FIG. 13

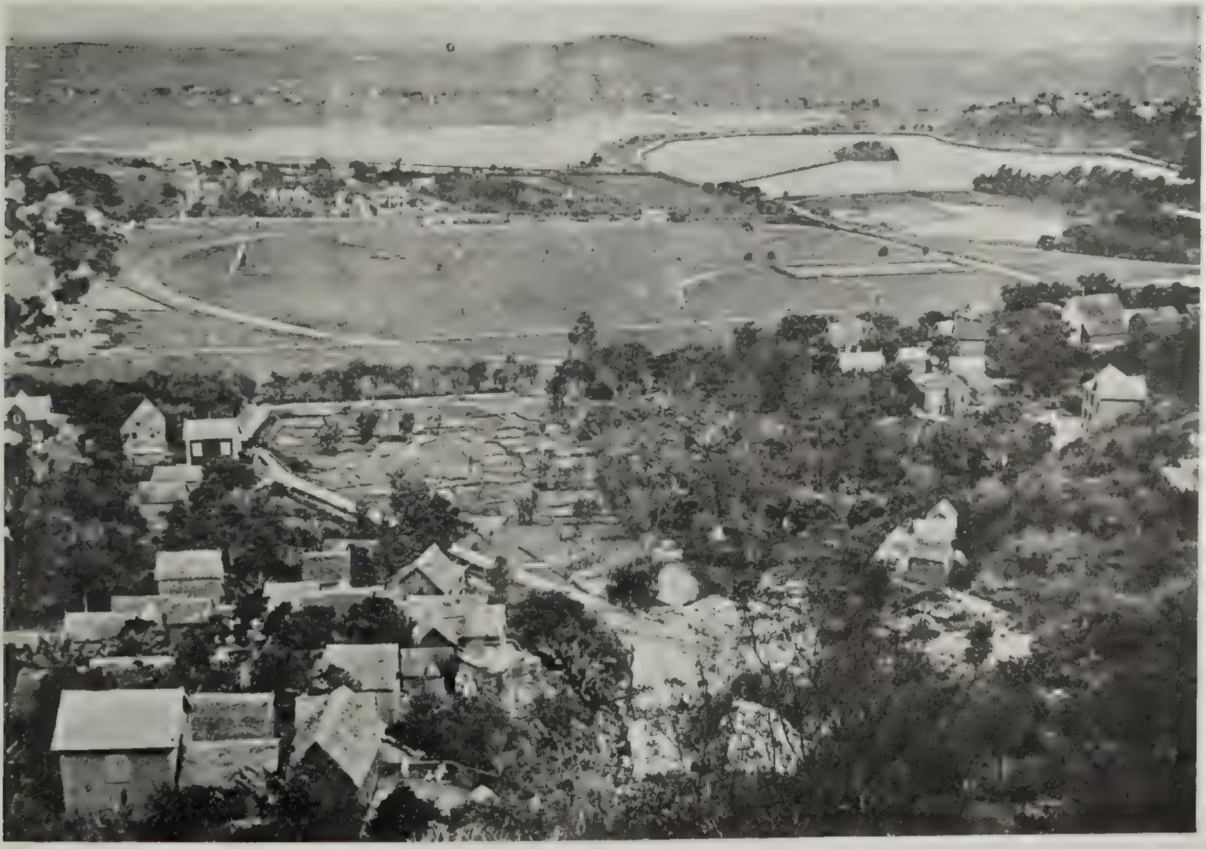

FIG. 14

FIG. 13—Antananarivo is built on a long and lofty hill rising above flat rice plains. The most conspicuous feature of the town is the great palace, Manjaka miadana, about 100 feet long by 65 feet broad and 120 feet in height. To the north (left) is the Trano Vola. The great palace has been converted into a museum.

FIG. 14—The parade ground, Mahamasina, at the western foot of Antananarivo, and the little lake of Anosy.

intervention ensued and finally the Hova came to terms. A treaty establishing a French protectorate over Madagascar was ratified early in 1886, and a Resident was appointed, M. Le Myre de Vilers. The political situation however was not permanently cleared, although no open breach occurred for some years. Then one day several Frenchmen were assassinated, and it became obvious that war was imminent. To avoid so grave a contingency an attempt at conciliation was made anew by Le Myre de Vilers; but his overtures failed, and he with his compatriots withdrew from Antananarivo.

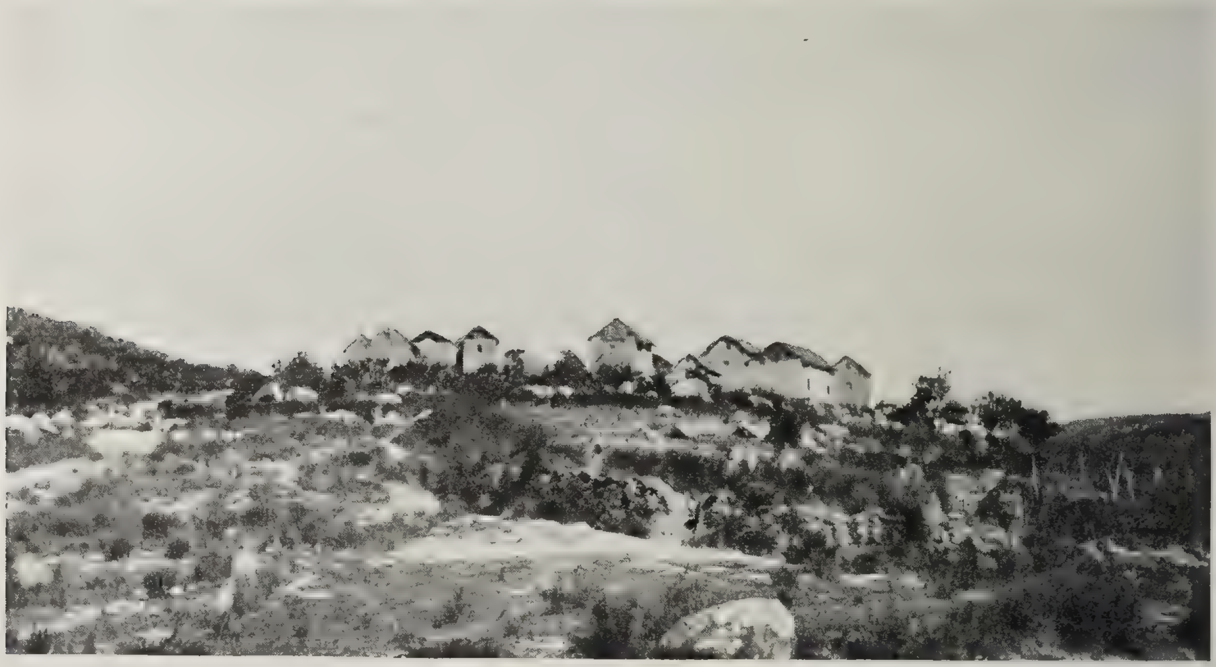

Fig. 15—A village of Imerina. On the barren upland of the central plateau the houses are built of adobe. The hard, compact red earth that forms so intractable a soil to the agriculturist offers, on the other hand, an excellent material for the mason—it has almost the solidity of stonework.

French Intervention

An expeditionary force was organized under the command of General Duchesne. The marines were ordered to the immediate occupation of Tamatave, the chief port of the eastern coast, and of Majunga on the western coast. On February 12, 1895, the Queen held a solemn *kabary* in which she made an appeal to arms and decided to muster the Hova and Betsileo. On May 6 General Duchesne and the expeditionary force arrived at Majunga. Landing proved difficult; provisioning of the troops required construction of a cart road; arduous labor in a trying climate exacted a considerable toll from the troops although no enemy resistance was encountered for some 170 kilometers south of Majunga. Here a Hova force was routed, and General Duchesne proceeded with little opposition. A flying column was formed to cross the Ambohimena Mountains, the natural protective wall of Imerina. After some skirmishing the column reached a point overlooking Antananarivo and the Betsimitatatra, the vast marshy plain out of which rises the hill upon which the capital is built. Turning eastward the little troop, without a blow, took Ambohidempona, some kilometers from the capital which from this point was within artillery range. The movement proved entirely successful. For defense reliance had been placed on the marshy plain which is one immense rice field, and the turning of the French force to the eastward was construed as a retreat. The appearance of the French troops at Ambohidempona took the populace by surprise. The first cannon shot paralyzed them with fear, and when presently a shell dropped near the palace the Queen hastened to raise the white flag. Thus ended the campaign.

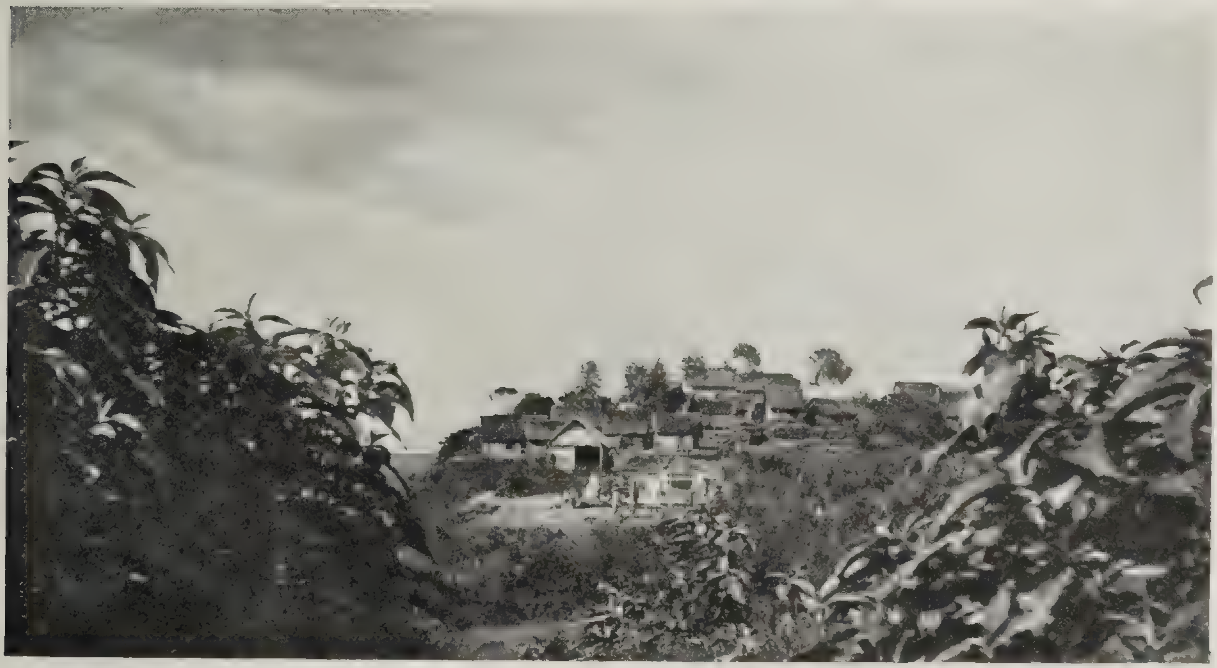

FIG. 16—A village in eastern forest belt, Vinanitelo, east of Fianarantsoa. The forest provides the material —bamboo, raffia, etc.—for construction of the houses.

REBELLION

On October 1, having installed himself in the Residency, General Duchesne contracted a treaty of peace. On the arrival of M. Laroche as Resident General the treaty which was reciprocal in character was modified into an act binding the natives to acknowledge the French protectorate over the island. But peace proved to be of short duration. Discontented Hova rose in rebellion, attempting a revival of their ancient pagan cult in the rural districts. A missionary, the Rev. W. Johnston, and his wife and daughter were killed. The insurrection was quelled, the Prime Minister exiled, and General Duchesne believing quiet restored left the country under the control of the Resident General. Then trouble broke forth again. The Hova had continued secret preparations for a "holy war," and Imerina from north to south was shortly aflame with insurrection in the course of which several Europeans were massacred.

THE ADVENT OF GALLIENI

In August, 1896, France sent to Madagascar General Gallieni the valiant soldier and skillful administrator who had played so remarkable a part in French West Africa and in Tonkin. Gallieni reached Antananarivo in September to find all Imerina in open revolt. The situation was extremely bad. It had been still further aggravated by the sudden abolition of slavery, lightly pronounced by M. Laroche, and by the antagonism between the Protestant and Catholic missions. Without delay Gallieni summoned the Queen, who visited him as a vassal of France. Although without actual authority the Queen acted as the center of rebellion; hence it was deemed advisable to exile her, and shortly afterwards she was sent to Réunion. Meanwhile Gallieni proceeded to the pacification of the country.

In the campaign of 1895 the French troops had advanced from the coast toward Antananarivo. The pacification of 1897 progressed from Antananarivo as center towards the coast by the procedure known as the "oil stain." From a strongly fortified center are deployed a series of little posts whence pacification is extended in ever-widening circles. Thus Imerina was progressively occupied without the striking of a blow, the more easily so by reason of the policy of lending resources and financial help instead of extorting tribute as under the native régime.

Progress of Pacification

In the first half of 1896 only certain parts of Imerina and Betsileo were occupied. At the end of this year the French were masters of these two provinces with the two supply routes leading to Tamatave and Majunga respectively. By October, 1897, France had control over the entire north of the island, the province of Bara, and a coast zone extending to the southeast as far as Fort Dauphin. By the end of the year there remained only the extreme south and some points in Menabi on the western slope, and their conquest was completed in 1901–1902.

The method of pacification is described by General Gallieni himself[11] in one of his reports in which he addresses his subordinates significantly enough as his collaborators.

> The best method of pacification is to be found in the joint use of force and policy. In colonial campaigns destructive force should be used only in the last extremity and even then only that reconstruction may be the better. The country and its inhabitants should be treated with the utmost circumspection for it is to be the scene of colonization in the future, and its peoples will be the chief agents and associates in our enterprises to be undertaken therein. On every occasion when the exigencies of war compel a colonial officer to proceed against a village he should keep in clear view that, submission being secured, the first step is reconstruction of the village, creation of a market, establishment of a school. It is by this joint action of policy and force that pacification is accomplished and the way paved for the organization to which it later gives place.

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[11] Compare the description of General Lyautey's pacification of Morocco, by Alfred de Tarde, in "The Work of France in Morocco," *Geogr. Rev.*, Vol. 8, 1919, pp. 1–30. Lyautey served under General Gallieni in Madagascar.

Roads and Railroads

While the troops were extending the limits of French authority workmen were engaged in road building to put the interior in connection with the sea, a task formidable enough under the conditions of climate and topography, especially on the eastern side of the island. Here an admirable system of roads now testifies to the triumph of the indomitable colonial spirit over the gloomy prognostications of friend and foe alike. On the western side, too, where surface and rainfall offer better conditions for road making and preservation, effort has been not less considerable.

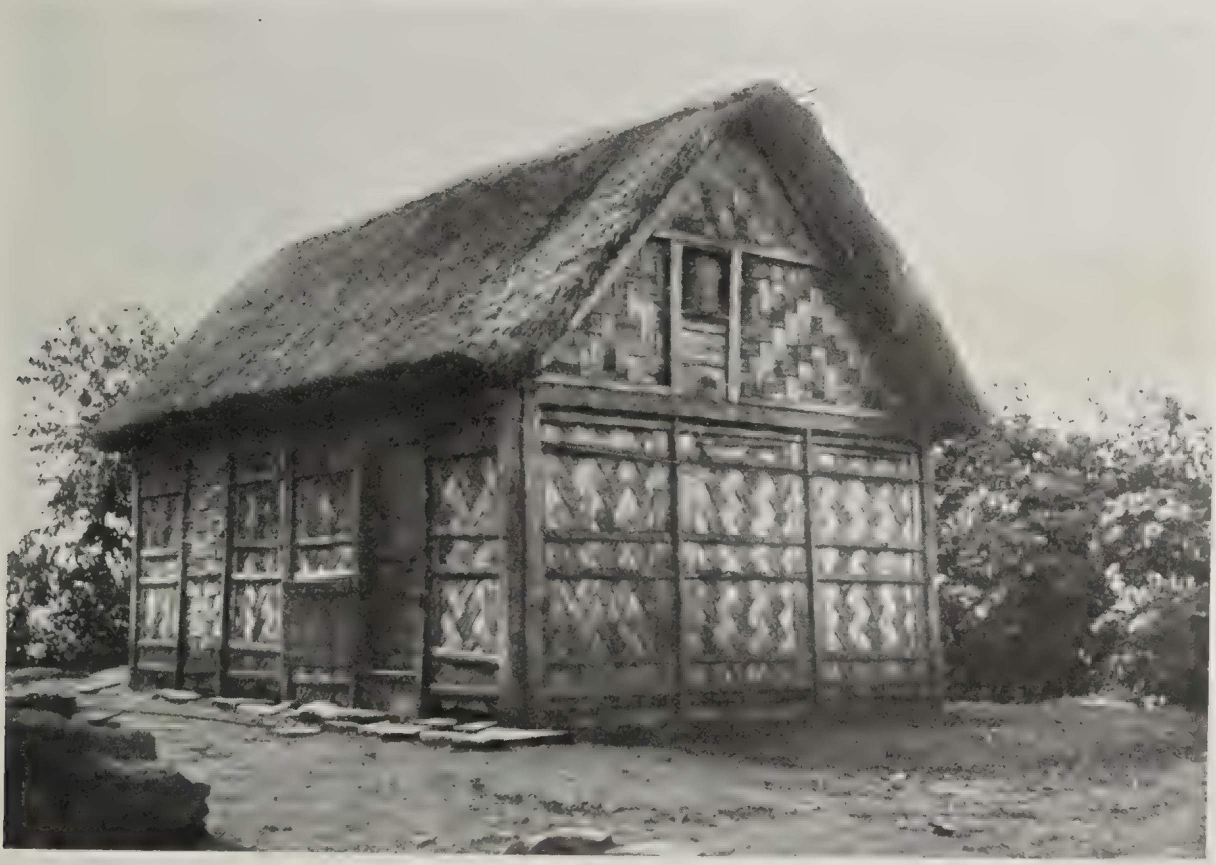
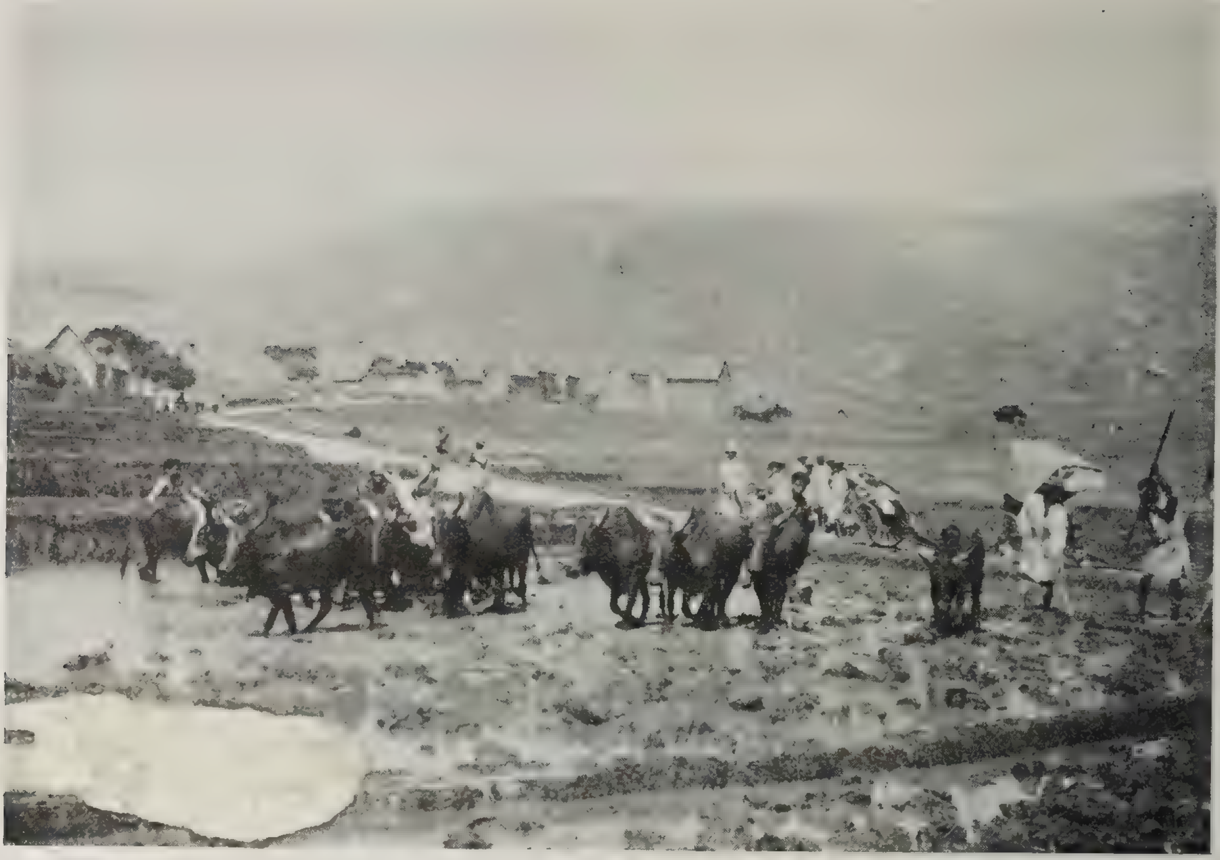


Fig. 17—A house of the eastern region; walls of bamboo.

In connection with the development of ways of communication note must also be made of the railroads, of which the chief is that from Tamatave to Antananarivo. In such a country as Madagascar the railroad is an important instrument of civilization. The course of construction provides large numbers of natives with a training of considerable industrial and moral value. When completed, the railroad furnishes a unique means of breaking down the barriers that isolate the native races and prevent the fusion of their common interests. On the economic side the Antananarivo-Tamatave railroad has provided an outlet for the best part of Madagascar. Imerina, isolated by nature, is the home of some million people, industrious and intelligent; who are, furthermore, the government's best auxiliaries for the economic and social development of the littoral and intermediate zones.



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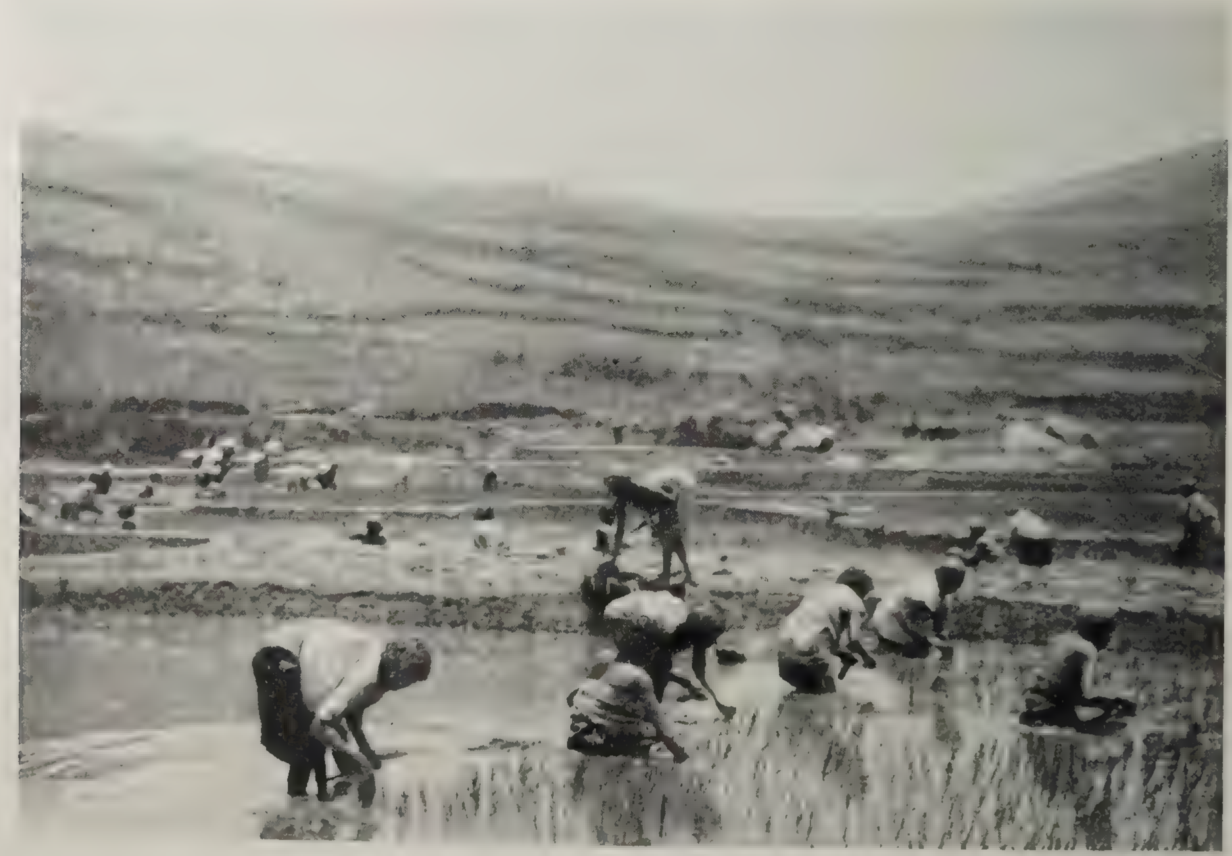
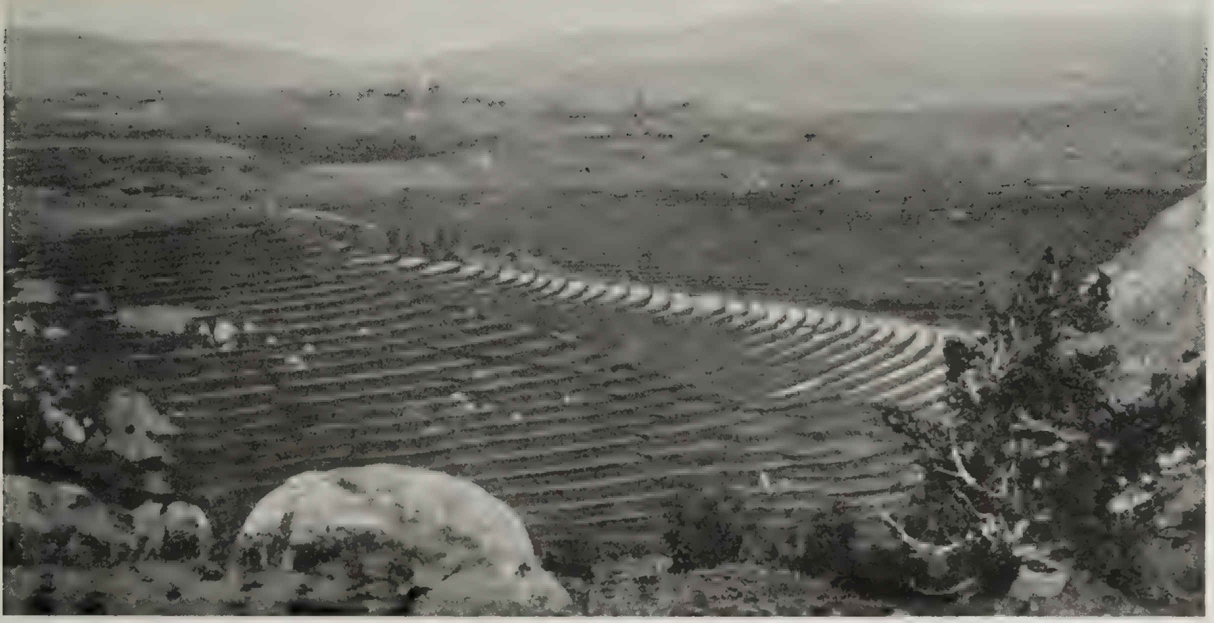


B

FIG. 18 A and B—Production of rice, food staple of the Malagasy. A. Oxen used in trampling the soil to prepare it for rice planting. B. Transplanting the rice. This is done after the summer rains have commenced (October and November).



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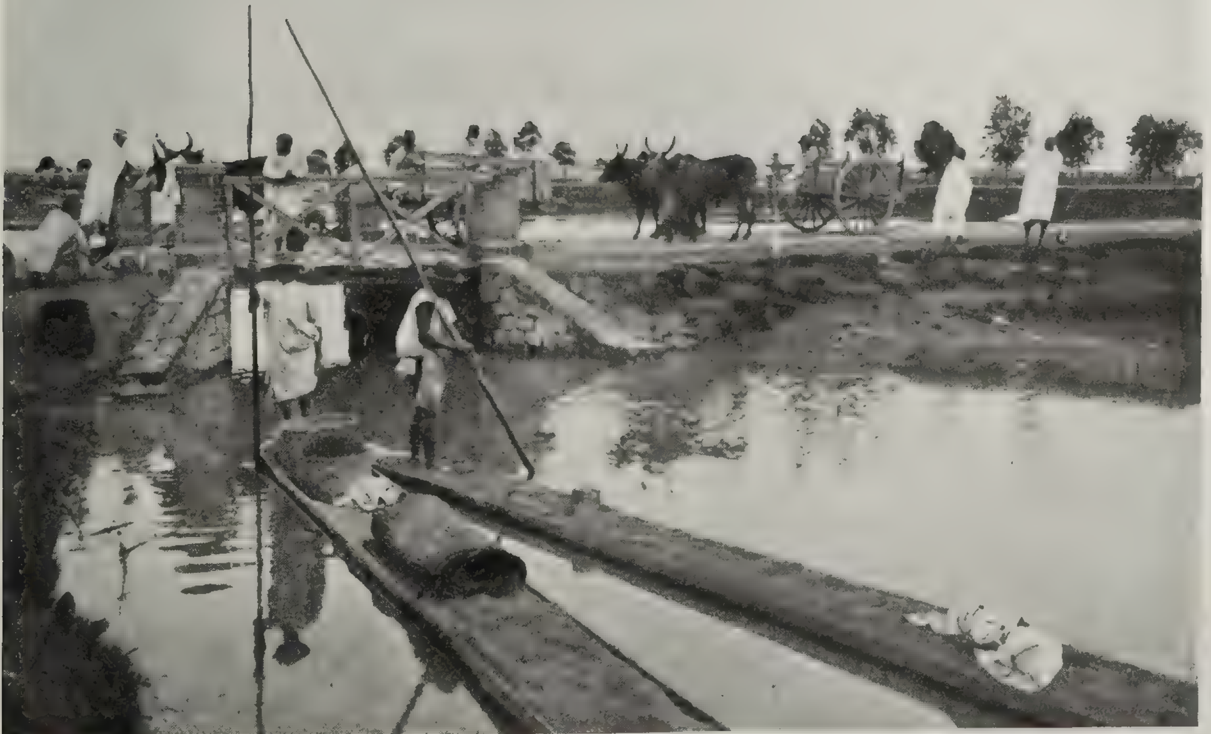

D

FIG. 18 C and D—Production of rice. C. Terraced rice fields on a hillside in the Betsileo country. D. Transport of rice by canoe, vicinity of Antananarivo.

General Gallieni was not less occupied with the political and administrative sides of pacification. As order was established laws were framed to meet the requirements of the new situation. By a decree of October, 1898, a judicial service was instituted. Although the system is susceptible of improvement, nevertheless it has proved well adapted to native needs and has contributed no little to attach people to French authority. To give an idea of progress in this direction we may instance the following case. During the last days of the dictatorship of Rainilaiarivony, an uncle of Queen Ranavalona III, formerly a butcher and completely illiterate, was Keeper of the Seals of the Malagasy Government. A subordinate was charged with the august commission of guiding his hand when his signature was required!

Public Instruction

From modest beginnings, since the first schoolmasters were soldiers, heads of isolated posts scattered here and there through the island, public instruction has become one of the important departments of the present administration. Long before, it is true, missions of various nationalities had opened schools, but the instruction provided was essentially sectarian in character. As soon as the colony had at its disposition the necessary funds it not only drew up an official course of study for the free schools but also founded "government schools," which were strictly nonsectarian. The government schools are largely vocational, laying stress upon instruction in industry and agriculture and also in the French language. The professional school of Antananarivo under direction of the Department of Public Works has already trained tanners, weavers, potters, blacksmiths, watchmakers, jewelers, cabinetmakers, etc. That the students have gained a thorough knowledge of their trades has been proved by their work in the governmental shops, in their employ by private individuals, and in the businesses which they have set up on their own account. In 1914 the number of schools had grown to about 2,000 with over 150,000 pupils.

Improvements in Agriculture

One of the most striking results of French occupation is the immense impetus that has been given to native cultivation. Suppression of slavery had for its first result an increase in the number of landowners. Whereas formerly a free man and his slaves cultivated an area just sufficient for their support, emancipation released a large body of workers who took up unoccupied parcels of land to which they acquired proprietary title in return for rendering them productive.

If today in certain districts of the central region the price of rice has fallen to a few cents a *vata*, or double decaliter, it is because one no longer finds marshes with their stagnant waters. Every valley is drained, irrigated, and converted into rice fields. As for the hillsides they are transformed with their cultivations of manioc, white and sweet potatoes, and groundnuts.

LABOR

A vital question for every colony is that of labor. In Madagascar although not superabundant it suffices for present needs. Recruits, except in Sakalava where the population is sparse, respond readily to regular pay and good treatment. Yet, looking to the future the French government is not satisfied with the present sparseness of the population, which, as has been said before, numbers not much over 3,000,000. The people of the central plateau, the Hova and Betsileo, who represent so large a proportion of the population, are remarkably prolific, and maternity is in honor among the young women. But the children, ill-nourished, ill-clothed, ill-cared-for generally, not infrequently victims of superstitious practices, die in such great numbers that the peoples of the central region as well as those of the coast were well on the way toward extinction when the French government intervened on behalf of their physical and moral welfare.

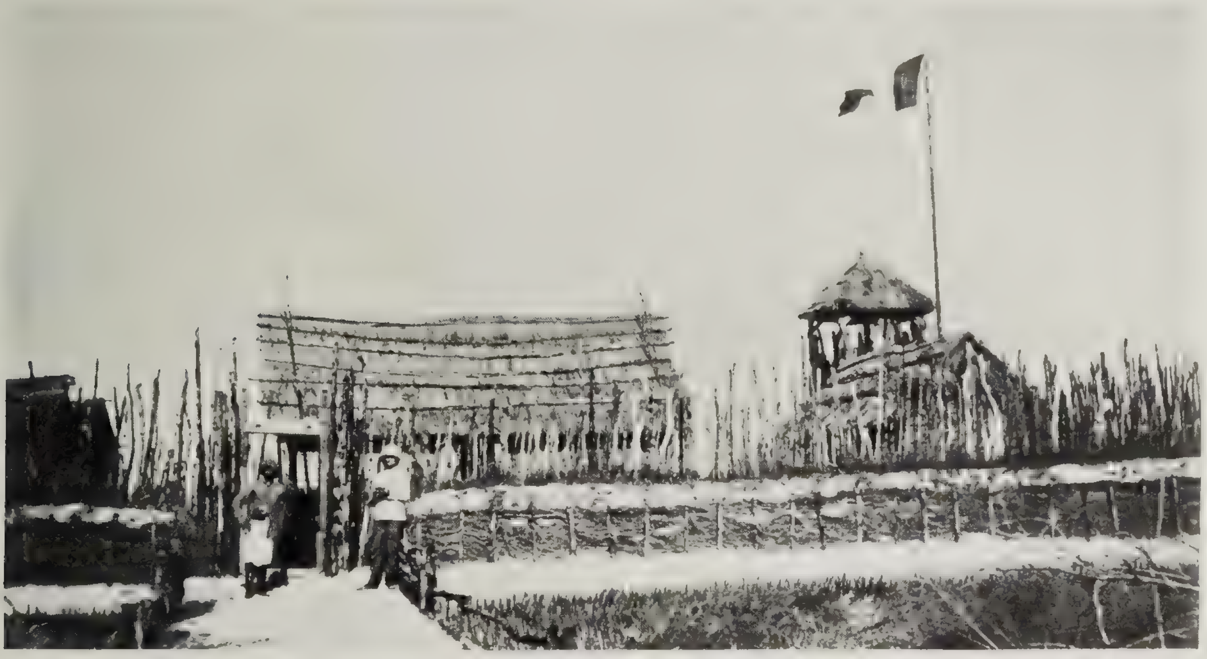

FIG. 19—A French fort in the western region of Madagascar.

How can the number of Malagasy subjects be increased? The answer is simple enough. The excessive infant mortality must be stopped. Among adults smallpox, malaria, syphilis, tuberculosis, and various epidemic diseases must be combatted. Such contagious diseases as leprosy must be isolated, and the general conditions of material existence ameliorated.

A Pasteur Institute established at Antananarivo in 1900 has furnished enough vaccine to permit the physicians of the health stations to inoculate the general mass of population. Today one hears no more of smallpox, that frightful malady significantly known among the Malagasy as *lavara* ("stay-far-away"). To second the efforts of the Bacteriological Institute of Antananarivo another station was established at Diego Suarez, and smallpox disappeared from the Sakalava and Antankarana. Thanks also to the Institute of Antananarivo the plague, while still prevalent in Mauritius and India, has disappeared from Tamatave and Majunga. Hydrophobia, the existence of which in Madagascar has been denied, has on the contrary claimed a number of victims. The reputation of the Pasteur Institute has spread, however, and one frequently sees natives who have made journeys of several weeks for treatment. In 1902, through the use of the serum provided by the Institute, an epidemic of diphtheria was under control in a few days. Steps are being taken towards control of malaria along the lines which have proved so successful in Cuba and along the Suez Canal and in the Panama Canal zone.

In fine the history of the nine years during which Gallieni had in hand the destiny of the Great Island,[12] is a veritable epic achievement in its military, administrative, economic, and financial aspects. It has all been accomplished not only to the glory of the mother country but to the benefit of the land itself, in accordance with the practice of the Romans, the conquering and colonizing people *par excellence*, of the "politique des races."

Thanks to Gallieni and his distinguished successors Madagascar is today "France Orientale." The native population has accepted French authority, not only without recrimination but with a gratitude that was expressed in 1916 when 42,000 Malagasy volunteered in defense of the mother country. What better proof could be asked of the work of French colonization in Madagascar?

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[12] Joseph Gallieni: Neuf ans à Madagascar, Paris, 1908.

THE ARRANGEMENT OF RURAL POPULATIONS

By M. Aurousseau
University of Western Australia, Perth

The distribution of population, which may be defined as the relative density of population per unit of area in different regions, has been the subject of considerable study by geographers. In many regions of a given density, however, the study of good maps of a scale of not less than 1:100,000 will often indicate, while actual examination of such regions will confirm, the presence of a finer adjustment, which is expressed in a characteristic grouping of dwellings. To this grouping the term "arrangement" has been applied.[1]

During the course of the war, the writer was enabled to make extensive observations on the subject in Egypt, France, Belgium, and England, the results of which are of considerable interest. The evidence collected in the field was very striking, and a research into the literature of the subject which is available in Australia indicates that it has received very little definite recognition by geographers with the exception of those of the French school; who refer occasionally to agglomerations and disseminations, which are only the extreme types. Various writers dealing with particular regions refer incidentally to the grouping which prevails throughout or in parts of the regions concerned; but with the exception of the village community, which possesses an extensive economic literature[2] there has been no attempt to co-ordinate the various existing arrangements or to discuss their origin and significance.

It was evident at the outset that the geographic study of the arrangement of rural populations must proceed hand in hand with that of the historical and economic aspects of the question. Robinson's History of Western Europe[3] and Ashley's Economic History[4] served as excellent starting points in the latter respect. The geographic method was that followed by Privat-Deschanel[5] and Griffith Taylor[6] who begin with the natural region.

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[1] M. Aurousseau: The Arrangement of the Rural Population in Picardy and Flanders, *Geogr. Journ.*, Vol. 51, 1918, pp. 393–394.

[2] G. L. Gomme: The Village Community, London, 1890.

Paul Vinogradoff: Villainage in England, Oxford, 1892.

Frederic Seebohm: The English Village Community. Reprinted from the fourth edition (1905). Reissue, London, 1913.

H. S. Maine: Village-Communities in the East and West. 2nd edit., London, 1872. References to German authorities.

[3] J. H. Robinson: An Introduction to the History of Western Europe, 2 vols., Ginn & Co., Boston, 1902–04. Numerous references.

[4] W. J. Ashley: An Introduction to English Economic History and Theory, Vol. 1, Part I, London, 1913, Vol. 1, Part II, London, 1914. Numerous references to French and German authorities.

[5] Paul Privat-Deschanel: The Influence of Geography on the Distribution of the Population of Scotland, *Scottish Geogr. Mag.*, Vol. 18, 1902, pp. 577–587. Originally published in the *Bull. Soc. de Géogr. de Lyon*, Vol. 17, 1901–02, pp. 545–559.

[6] Griffith Taylor: Geographical Factors Controlling the Settlement of Tropical Australia, *Queensland Geogr. Journ.*, Vols. 32–33, 1918, pp. 1–67.

It was found that, at the present day, in civilized countries which possess a high degree of social freedom each natural region tends to develop a characteristic form of arrangement of its rural population, while in more backward countries social organization is a more powerful factor than physiography. The historic tendency is, in general, for an initial social arrangement to break down with advancing civilization and to be replaced by a more appropriate response to physiographic conditions. The geographer can therefore recognize at the present time various forms of agglomerations, partial agglomerations, and disseminations. They are not susceptible of systematic classification but are none the less real, being in each case a delicate expression of the social condition or physiography of the region concerned, or of both. In many instances arrangement in both the horizontal and vertical senses is discernible.

Agglomerations

The following forms of rural agglomerations are recognizable: small towns, villages, true village communities, and hamlets. In each case they owe their existence to some important social or geographic factor and, in themselves, exhibit an infinite variety of character and build, which changes from region to region.

SMALL TOWNS

Small towns are found in regions where the soil is very poor or restricted in extent; in oases, where irrigation is necessary for agriculture; and where defense is the prime necessity. As an instance of the first case we may take the country around Moscow, where the soil is so wretched—sandy or marshy—that rural industries entirely supplant agriculture and the whole population of the region has grouped itself into a number of small towns and villages.[7]

The oasis of Khargeh is an illustration of the second case, where the entire population of an area dependent on irrigation from an ancient Roman system of aqueducts and artesian wells has concentrated into one small town.[8]

In the mountainous regions of Algeria the population is grouped into small towns. Good soil is restricted in extent, and the need of segregation for defensive purposes is considerable. The arrangement, however, is eminently suitable to the population of fruit growers, whose farms are small and close to the towns.[9]

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[7] Alexander Woeikof: Le groupement de la population rurale en Russie, *Ann. de Géogr.*, Vol. 18, 1909, pp. 13–23.

[8] H. L. Breadnell: An Egyptian Oasis, London, 1919.

Mark Jefferson: Utah, the Oasis at the Foot of the Wasatch, *Geogr. Rev.*, Vol. 1, 1916, pp. 346–358, compares the Utah towns at the foot of the Wasatch with the Khargeh and the other oases of the Libyan Desert.

[9] Augustin Bernard and Edmond Doutté: L'habitation rurale des indigènes de l'Algérie, *Ann. de Géogr.*, Vol. 26, 1917, pp. 219–228.

VILLAGES

Villages, other than those of frontier marches, which exist for defensive reasons, and those of backward, barbaric, or savage countries, or those resulting from some unusual physiographic condition, are very frequently survivals, though in form only, of ancient systems of government and social organization. Their origin, which has been discussed at length by Seebohm and others, is an economic problem, but their survival is a geographic one. With this we will deal in a description of Picardy and South Wiltshire.[10]

VILLAGE ARRANGEMENT IN PICARDY

The name Picardy, like many of the provincial names of pre-Revolutionary France (*noms de pays*), belongs to a fairly well defined natural region.

Picardy is a lonely-looking land of low, naked, rolling hills, cut by tortuous mature valleys. Here and there a village is seen, frequently nestling in a hollow and closely-circled by trees. Otherwise there is not a house in sight, though the greater part of the country is under cultivation. A winding belt of poplars marks a neighboring valley, and a regular row of elms reveals a main road on the horizon. Other vegetation there is none, save an occasional dense wood of young trees on high ground. One seldom sees old trees in France. The underlying formation almost everywhere is the chalk with flints (Senonian) of the Upper Cretaceous, which yields a poor and shallow soil on the terraced hillsides. Occasional patches of alluvial soil, *terre à betteraves*, exist, especially where the low hills expand into small plateaus. The climate is continental and humid, moderated by proximity to the sea but becoming more rigorous inland. The villages are compact, generally several kilometers apart, dotted over the land quite regularly, and connected by good roads, too numerous for inter-village communication alone. The land has hence a characteristic "knotted and netted" appearance. The farmer lives not on his farm, far from neighbors, in a bleak and melancholy country, but in the village, setting out daily with his team, one of the numerous roads serving his convenience.

The village arrangement in Picardy is a survival, though in form only, of the manorial system, in many cases of the Roman system, or even of the primitive village community. The very common terminations *-ville* and *-court* in place names and the château with its park testify in many villages to the former existence of manors or villas, while the universal occurrence of *remblais*, or terraces on the hillsides, and of embanked and sunken roads is evidence of the ancient open field system of cultivation. That the arrangement has survived long after the restriction of ancient land tenure[11] has been removed is explained by the physiography of the country. The chalk hills are dry, which is expressed in such place names as Sailly-le-Sec, Avesnes-le-Sec; and permanent supplies of good ground water are only obtainable in the valleys, or at the intersections of joints or faults in the chalk, or by the sinking of very deep wells.[12] Dwellings are hence concentrated around points of assured water supply. Horses are watered at the communal pond of each village, which contains water throughout the year and is fed by the run-off from the roofs and streets; but it is no uncommon sight to see casks of water being taken on sledges from the villages to the browsing cattle in the fields. The dew pond appears to be unknown. The country being agricultural, it has been necessary to spread the villages evenly over the land. Wherever possible, a low site has been chosen to ensure protection from the wind; but villages on elevated sites are by no means uncommon. All the villages are old, and increase in population is expressed by expansion of existing villages rather than by establishment of new ones. A variety of crops is grown, but the only important industries are the extraction of beet sugar and the manufacture of bricks. Occasionally, as where a small, swift stream has supplied power, a village has expanded into a small industrial town (e.g. Albert-sur-Ancre). In the east of Picardy and Artois the white chalk (Senonian) thins out, and the ground water level rises accordingly, permitting the existence of a few isolated farms and dwellings such as those around Le Cateau.

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[10] See also M. Aurousseau: A Contrast in Chalk-Lands, *Scottish Geogr. Mag.*, Vol. 36, 1920, pp. 158–161.

[11] Ashley, *op. cit.*, Vol. 1, Part I.

An arrangement which closely resembles that of Picardy is to be found on the same geological formation in parts of Hainault.[13]

VILLAGE ARRANGEMENT ON THE SOUTH WILTSHIRE DOWNS

South Wiltshire has many points of resemblance to Picardy but in other ways offers sharp contrasts. Its dominating feature is the chalk area of Salisbury Plain, a bare, rolling expanse of turf-covered downs, 500 to 800 feet above sea level and untilled except in the neighborhood of the valleys. The sweeping hills have a convexity of outline which is characteristic of chalk topography. The woods and copses are poor and scattered at random. The "Plain" is dissected by dry valleys, "winter bourns,"[14] and five small streams which converge on Salisbury like fingers joining a hand. The stream valleys are comparatively straight but are in the early stages of mature development, their floors of rich, deep alluvium stretching out into broad water meadows and wooded parks. The whole region is bleak and of more rigorous climate than the surrounding districts; but the Plain is, and always has been, one of the most free and open regions of England. The most extensively developed formation is the chalk with flints (Senonian). Ground water is confined to the lower-lying areas in the valleys, and its absence on the high downs is to some extent compensated by the construction of dew ponds.

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[12] Henri Hitier: Le village picard, *Ann. de Géogr.*, Vol. 12, 1903, pp. 109–119.

Albert Demangeon: La Picardie, Paris, 1905, pp. 372–386. See especially Fig. 27, p. 373, showing the phenomenon of agglomeration on the chalk plateaus in contrast with that of dispersion in the region of Normandy.

[13] Maurice Leriche: Les régions naturelles de la Belgique, *Rev. de l'Université de Bruxelles*, Vol. 19, 1913–14, pp. 185-217.

[14] W. H. Hudson: A Shepherd's Life, London, 1919.

Salisbury Plain from the earliest times has had considerable interest in the present connection. This open spot in ancient, forest-clad Britain attracted an early population, traces of which such as the long barrows, round barrows, Stonehenge, and the early British earthworks of Yarnbury Castle and Codford Circle are abundant. In Saxon times the Plain was probably occupied under the tribal system. The Danes coveted the area and were met and beaten on it by Alfred the Great at Edington. The Romans occupied it extensively, as Old Sarum, traces of roads, and the remains of villas near Warminster testify. With the clearing of the valleys the population forsook the high downs, took to the low ground, and settled down to sheep farming and weaving, which persisted through the manorial ages until the industrial revolution.[15] Since then weaving has ceased, the old, horned downland sheep has become extinct,[16] and pastoralism is slowly yielding to agriculture.

At the present time, small, decadent, but beautiful villages are scattered along the valleys or nestle in lonely and sheltered spots. The only village on high ground known to the writer is Mere on the very southwestern corner of the Plain. Isolated dwellings are extremely rare. The villages of South Wiltshire are similar in origin to those of Picardy. They represent the surviving form of the ancient manors, many of the manor sites being still in evidence; while the occasional occurrence of *linchets*, which correspond to the *remblais* of Picardy, is an expression of the old methods of agriculture.[17] The village system is imposed at the present day owing to the exigencies of water supply. It is noteworthy, however, that, whereas the agricultural population of Picardy has spread evenly over the whole area and frequently occupies high ground, the pastoral population of Salisbury Plain is confined to the valleys and other low ground. From being formerly an attractive area to population the Plain has now become a relatively repellant area. This description is applicable to many other parts of the English chalk lands, especially in northern Hampshire.

Villages on Calcareous Formations

The two foregoing instances illustrate the extraordinary power possessed by calcareous formations in determining the survival of villages. Examples could be multiplied to such an extent that we can distinguish a class of survivals which we will term the *lime land villages*. Gallois describes the parallel case of the calcareous plateau of La Beauce,[18] and Gravier notes the strong influence of limestone in parts of Lorraine.[19]

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[15] Arnold Toynbee: Lectures on the Industrial Revolution of the Eighteenth Century in England, London, 1884.

[16] P. McConnell: The Elements of Agricultural Geology, London, 1902.

[17] Gomme, *op. cit.*

A further type of control exhibited by calcareous formations is to be seen in the *marginal girdle villages*, which occur on the spring line around the edges of many calcareous areas. For instance "in part of the Weald district the parishes are long and narrow, crossing the strike of the strata at right angles and securing to each a strip of sheep pasture on the chalk downs, a strip of dry but water-bearing rock suited for a village site on the Upper Greensand, a strip of stiff arable land on the Gault, and a strip of rough cattle pasture on the Lower Greensand, where the river runs with its water carriage and water power."[20] Again, in the region of La Vôge in the upper basin of the Saône a line of villages is found on the marls bordering the limestones on the left bank of the Saône and also on the western margin of the Vôge, where no less than 20 villages occur in a distance of 35 kilometers. Cereals are grown on the limestones while the marls are used for pasture and the sandstone for forestry.[21] A well developed belt of marginal girdle villages exists also around Salisbury Plain.

"Wet Point" and "Dry Point" Villages

Apart from the arrangements determined by the peculiarities of the hydrography of calcareous formations we have two special cases of arrangements governed by water supply—the extreme conditions giving rise to what we will term *wet point villages* and *dry point villages*. The former class is exemplified by the villages of the Grodno, Minsk, and Mohilev Governments in Russia, situated on the *terre noire* which provides but scanty and localized supplies of permanent ground water.[22] Woeikof also gives instances of dry point villages in the marshy regions in the south of Minsk, but the most striking case is that of the Nile Delta, which we will describe in detail.

The Nile Delta is an area of most unusual fertility, a flat expanse of deep, rich loam and black mud dissected by the uncertain branching river and cut by numerous canals. For the greater part of the year it is an emerald expanse of crops of infinite variety. The date palm alone, in clumps and groves, rears itself above the common level. There is nothing except the dazzling whiteness of a sheik's tomb or a drab mud village to relieve the eye of the green monotony until the distant line of the brown desert is reached. A complex system of irrigation has pushed intense culture to the very border of the desert and beyond it. With water highways and primitive transport, roads are few and narrow. Irrigation channels and a few hedges are the only boundaries of fields. The climate is subtropical and rainless, with great ranges of temperature in winter.

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[18] Lucien Gallois: Régions naturelles et noms de pays: Étude sur la région parisienne, Paris, 1908; p. 55 *et sqq.*

[19] Gaston Gravier: La Plaine Lorraine, *Ann. de Géogr.*, Vol. 19, 1910, pp. 440–455.

[20] H. R. Mill: The Development of Habitable Lands: An Essay in Anthropogeography, *Scottish Geogr. Mag.*, Vol. 16, 1900, pp. 121–138; reference on p. 131.

[21] A. Cholley: La Vôge, *Ann. de Géogr.*, Vol. 23, 1914, pp. 219–235.

[22] Woeikof, *loc. cit.*

The general landscape gives no adequate idea of the teeming population which lives in the thickly scattered villages. These are compact, crowded collections of small buildings, house next to house, made of sun-dried bricks and more or less walled in. The only isolated buildings are the white, domed tombs of sheiks. The villages are mostly situated on slight eminences composed of rubbish and representing the accumulation of centuries of building and rebuilding on the same site.[23] There are few large towns, and cities do not encroach on the valuable land of the delta. Cairo itself, situated at the apex, is extending a horn of suburbs to the northeast, not on the alluvium but between "the desert and the sown." This arrangement of dense nuclei, sited on mounds, without isolated dwellings, is rendered necessary by the extreme liability of the area to annual inundation.

Prolonged Turkish misrule has so effectively obliterated old institutions in Egypt that in Lane's time the *fellahîn* had been reduced to the condition of wretched laborers. They held no property, the land being in the hands of the pasha class or of foreign landowners. Now, however, the *fellah* is frequently a small landowner. The land is steadily passing back into Egyptian hands, but the liability to inundation will effectively block any tendency towards dissemination in spite of the increase of the number of small holdings.

Dry point villages similar to those of Egypt are found also in the low lying parts of Flanders, on the landward side of the dune belt. They consist of strings of houses built on dykes or canal banks out of reach of inundation.[24] In the same category may be placed villages situated on alluvial cones in the Alpine valleys. A classical example is seen in the Rhone valley in Valais where each cone has its village thus placed above the intervening marshy flats.

"STRONG POINT" VILLAGES

Passing from the village survival, we will consider villages which have originated for defensive reasons. Defense is usually a secondary factor and is frequently no more than a temporary one. The villages south of the Oka, in Russia, were founded in the sixteenth century, land being granted in return for military services. The province was hence a frontier march. In the northern Caucasus also a similar state of affairs existed until 1864, when the land became secure and dissemination ensued with the production of small hamlets and isolated farms. The hamlets are proportional to the sizes of the estates.[25] Defensive villages are best developed in that shifting human region which exists on racial and international frontiers—the zone of strife. It has not received much acknowledgment as a human region. Such villages might well be termed *strong point villages.*

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[23] E. W. Lane: An Account of the Manners and Customs of the Modern Egyptians, 2 vols., London, 1837; reference in Vol. 1, pp. 28-29. On the village type in Egypt see also Jean Brunhes; La géographie humaine, Paris, 1912, pp. 135-141.

[24] Raoul Blanchard: Flanders, *Geogr. Rev.*, Vol. 4, 1917, pp. 417-433.

Villages owing their existence to special physiographic conditions are characteristic of areas of diverse physiographic elements, i.e. areas which do not form parts of well defined natural regions. They are extremely numerous, and the controlling factors are diverse. The studies of Faucher, and in particular of Sorre, are excellent in this connection. Faucher works out the siting of villages on the basis of soil, water supply, distribution of forests, etc., in Valence,[26] while Sorre has made a detailed geographic and historical study of part of Catalonia.[27] Sorre concludes that an historically uniform type is being replaced by a small number of forms geographically differentiated by concentration, at the expense of the intermediate elements (the hamlets). Rabot has carried out similar work in Sweden, where climate, soil, and the timber industry appear to be the important factors. He also remarks on the effects of calcareous formations.[28] The influence of powerfully developed physiographic features of an uncommon kind is well exhibited in the Norwegian fiord districts, where the small deltas at the heads of the fiords afford almost the only cultivable land and determine the sites of the small population centers.[29] Such centers may be termed *food point villages*, the occurrence of which might be expected in the borders of those regions particularly hostile towards man that Fleure has designated the "zone of hunger"[30] and on barren oceanic islands.

Village Communities

In barbaric and backward countries the village community is still in existence in many places. The conditions of social organization are such that the village arrangement is the only possible one, regardless of whether it be suited to the geographic conditions or not. Woeikof has described districts of the government of Kazan where the entire population dwelt in villages, where no personal property existed, everything belonging to the state or to communities of peasants.[31] In parts of Lorraine community life still survives in many ways.[32] The villagers still work in common, though common cultivation has long disappeared. The villages of the plains in Palestine still preserve many common customs, the land being often owned by the villagers in common and a fair division of it taking place every year or two.[33] The Indian village community has been the subject of exhaustive study by Sir Henry Maine, who draws many western parallels from the works of Nasse and Maurer, and more recently by B. H. Baden-Powell, who has specially investigated the economic side.[34]

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[25] Woeikof, *loc. cit.*

[26] D. Faucher: La plaine de Valence, *Ann. de Géogr.*, Vol. 23, 1914, pp. 127-150.

[27] Maximilien Sorre: Groupement des populations dans la Catalogne septentrionale, *Ann. de Géogr.*, Vol. 20, 1911, pp. 69-73.

[28] Charles Rabot: La distribution de la population en Suède en fonction de la constitution géologique du sol, *La Géographie*, Vol. 11, 1905, pp. 359-367.

[29] Hagbart Magnus: Zur Siedelungskunde von Norwegen, *Zeitschr. der Gesell. für Erdkunde*, Berlin, Vol. 33, 1898, pp. 367-392.

[30] H. J. Fleure: Human Regions, *Scottish Geogr. Mag.*, Vol. 35, 1919, pp. 94-105. This classification of world regions according to "the measure of the earth's response to man's efforts" has been noted in the *Geogr. Rev.*, Vol. 8, 1919, p. 277.

[31] Woeikof, *loc. cit.*

The village community must have existed in nearly every part of India, and there are abundant evidences of its survival. It is interesting, however, to note the exceptions which Matthai[35] quotes from Baden-Powell.

> First, the British Himalayan districts which contain a limited area of flat land and occasional patches of good soil on the hill side. People live here in single homesteads or in very small groups of two or three families. Secondly, along the west coast towards the south—the districts of North Kanara, South Kanara, and Malabar—the land here lying between the sea and the Western Ghat mountains is constantly intersected by hills and rivers and wide ravines. The inhabitants generally live in isolated homesteads, each with its own garden. Thirdly, the districts in the South Punjab below Multan where the country is so rainless that permanent cultivation is possible only under exceptional circumstances. To these may be added the tract of country along the North-West Frontier—Baluchistan, the North-West Frontier Province, and parts of Sind—where society is still organized in tribal rather than in village communities.

The village communities of savage and primitive races have been described by Gomme.[36]

The fate of the village community is invariably to disappear before the advance of ideas and to give way to the arrangement best suited to the geographic environment. The transition has actually been observed, as before mentioned, in the northern Caucasus but is best illustrated by the effects of voluntary and enforced enclosure of the common fields, which accompanied the agrarian revolution.[37] Slater's geographic study of the English parliamentary enclosures is noteworthy in this connection. He found, on plotting the enclosures, that they had a very definite distribution in an area stretching from Flamborough Head to the Solent, where the common field system had persisted in spite of all hostile attempts to crush it. He ascribes this to a high power of persistence which he considers the village communities of the area possessed by virtue of their origin and organization. It is remarkable, however, that the area of parliamentary enclosures corresponds to the distribution of the Mesozoic rocks in England, especially to the chalks, and it is probable that further investigations will ascribe the persistence to geographic environment, rather than to any peculiarity of organization of the communities of the area.[38] The great geographical result of enclosure upon the rural population was the development of partial or complete disseminations wherever the conditions were suitable, with the almost complete obliteration of the former system in many cases.

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[32] Gravier, *loc. cit.*

[33] J. D. Whiting: Village Life in the Holy Land, *Natl. Geogr. Mag.*, Vol. 25, 1914, pp. 249-314.

[34] Maine, *op. cit.*

B. H. Baden-Powell: The Land System of British India, 3 vols., Oxford, 1892; The Indian Village Community, London, 1896. See also John Matthai: Village Government in British India, London, 1915.

[35] Matthai, *op. cit.*, reference on p. 8.

[36] Gomme, *op. cit.*

[37] Ashley, *op. cit.*, Vol. 1, Part II.

Hamlets

The terms small town, village, and hamlet are purely relative. They are of considerable use, but it is not possible to give them a quantitative value, except in local cases, such as the development of villages and hamlets on contiguous areas of good and poor ground respectively. Hamlets, however, are the normal agglomerations on the poorer class of ground which is not suitable for a disseminated arrangement. They are well developed in a region such as the Ardennes and occur frequently on the Russian plain. A striking example of agglomeration was noticed by the writer in the Belgian province of Brabant, between Brussels and Charleroi, on the gently undulating country of the Tertiary clays, but he was unable to investigate it. The Dutch province of North Brabant also exhibits an agglomeration developed to an extraordinary degree on Quaternary deposits. There exist in the province 184 communes, in each of which is a village. The land is divided into very small holdings, and home industries are very important.[39] Otherwise Holland and Denmark are lands where dissemination prevails.

The foregoing considerations have dealt only with the sedentary types of agglomerations, which are characteristic of temperate or fertile regions. In the regions bordering both the hot and cold deserts, there is often a semi-sedentary population, which changes its place of abode according to the seasons in pursuit of pasture. The tented nomads of the desert and steppe regions of Morocco and Algeria, who occasionally practice agriculture in a fitful manner, are typical of the borders of the hot deserts, as are also the inhabitants of the shifting tent villages of the more arid parts of the Mesopotamian valley. In Algeria there is also a more advanced population practicing agriculture within the 20-inch rainfall belt. As the villagers cannot maintain fertility in the soil for long periods, they dwell in hutments, which are easily transported to new areas when the old become exhausted.[40]

The case of the cold deserts is still more interesting, as an example of semi-nomadism in Europe. The regular migrations of part of the Swiss population between the valley villages and the châlets of the Alps are well known, but an extreme instance is afforded by the Val d'Anniviers, where the number of groups of wooden dwellings, at different levels in the valley, which are temporarily occupied on a complicated system of migrations by the whole population at different times of the year, is out of all proportion to the number of inhabitants. The system of Anniviers is considered to be the outcome of increase in population in a restricted area from which there is practically no emigration.[41]

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[38] Gilbert Slater: The Inclosure of Common Fields Considered Geographically, *Geogr. Journ.*, Vol. 39, 1907, pp. 35-55.

[39] H. Blink: Studiën over Nederzettingen in Nederland, *Tijdschr. Kon. Nedere. Aardrijk. Genoot.*, 2nd series, Vol. 21, 1904, pp. 1-45.

[40] Reference cited in footnote 9.

Partial Agglomerations

The area of Entre Sambre et Meuse (Belgium) is an example of a partial agglomeration with which the writer is familiar. Together with the district of Condroz to the east of the Meuse it forms a physiographic unit with a gentle general slope downwards to the northwest. It consists of a series of roughly parallel troughs and hills of long, rounded form, known locally as *tiges*, which have a general trend along the direction east-northeast to west-southwest. Though for the most part bleak and open, the country has well wooded belts which increase in extent to the south. The climate is pleasant in summer but represents the passage from the maritime Flemish plains to the rigorous Ardennes. The geological structure of the country is very accurately expressed in its physiography. The whole region lies in the Dinant basin, which consists of a series of subsidiary folds on the main, great syncline. Dissection has resulted in a number of parallel and alternating outcrops of schists (Upper Devonian) and limestone (Carboniferous).[42] The normal physiography of folded regions has here been reversed, the long elevations of the *tiges* coinciding with the anticlines, while the troughs have been carved in the synclines. Furthermore, good supplies of ground water are obtainable in the high-lying schists of the *tiges*, while they are not in the limestone troughs.

Here again the arrangement of the population corresponds closely to the physiographic conditions. It is essentially an arrangement of villages with intervening isolated dwellings, though the latter are not abundant. The villages have, in many cases, been forced to occupy the bleak tops and flanks of the *tiges*, in preference to the sheltered but often waterless limestone troughs.[43] Favorable positions for isolated dwellings are, however, by no means lacking, and there is a fair scattering of farmhouses between the villages. The rural occupations are more varied than usual. Though the country is essentially agricultural, forestry is very important. Iron ore occurs in the neighborhood of Gerpinnes but has not been worked since the opening of the Lorraine fields. A number of small Tertiary outliers provide opportunities for the working of plastic clays and glass sands. Potteries and brickworks are to be found at various points. The limestones are often quarried for building purposes and for lime burning, while the schists are worked for paving stones. Most of the older houses are built of stone in preference to brick, and the village streets are frequently cobbled. There is a tendency to plant forests on the high-lying Devonian schists (*végétation calcifuge*), while agriculture is practiced largely on the carboniferous limestones of the lower ground (*végétation calcicole*). The existence of so many rural industries has led to the formation of rather large, straggling villages and has rendered necessary a system of light railways.

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[41] Jean Brunhes and Paul Girardin: Les groupes d'habitations du Val d'Anniviers comme types d'établissements humains, *Ann. de Géogr.*, Vol. 15, 1906, pp. 329-351.

[42] M. Aurousseau: An Outline of the Geology of Entre Sambre et Meuse, Australian Corps, Belgium, 1919.

[43] Leriche, *loc. cit.*

Disseminations

The modern tendency towards dissemination usually achieves its most complete development on fertile ground. Disseminations generally result from the voluntary breaking away from older organizations in ancient countries, but under certain circumstances dissemination has been enforced. The normal method of settlement of the newer lands is by dissemination, though America was exceptional in that the early white settlement was under the village community system. We will examine three forms of dissemination which have been brought about by voluntary action.

Complete Dissemination: Flanders

The French part of the plain of Flanders constitutes about three-fifths of the Département du Nord and a small corner of the Pas-de-Calais. It stretches from the sea to the Scheldt and the Sensée. The landscape is flat and enclosed, with occasional noble vistas through the trees into green and fertile distances, dotted with red (thatched or tiled) cottages, and seldom broken by an undulation until the foothills of Artois are reached. The only feature of importance is the beautiful chain of residual heights stretching from Cassel to Kemmel and studded with windmills. Ditches and hedges line the roadsides and fields; sluggish brooks, tamed and canalized streams, and long canals traverse the plain. Woods are rare; but trees abound, distributed regularly around the edges of fields and along the roadways. Not an acre of ground remains untilled except the rich little pasture field on each farm. The roads are straight and tend to cross at right angles. The whole scene is one of checkerboard regularity and garden formality, recalling the picture-book landscapes of our childhood or the Solano target.

The predominant formations are soft clays (Lower Eocene—Yprésien). Though the soil is not of the best quality in itself, it has been wonderfully enriched by prolonged scientific agriculture. The climate is maritime, humid, and more temperate than that of Picardy. The waterways are seldom frozen sufficiently to bear a skater.

With a good soil, providing abundant ground water, holdings are small and every man lives on his farm. Ground water is so abundant that many of the farmhouses are moated, and all possess a pool. An elaborate system of draining and ditching is necessary. Mixed farming is practiced, under an intensive system of agriculture. The houses are so placed that there is easy access to all parts of the farm and to the neighboring road,[44] and they are so thickly and evenly scattered that true villages are often difficult to define. Small, straggling towns merge imperceptibly into the normal countryside. The general arrangement here, as in Picardy, gives the map a characteristic appearance, the regular intersections of roads and ditches giving rise, in such regions as that to the southwest of Armentières, to a series of perfect parallelograms, best seen on the 1:40,000 scale maps. Though Flanders was under the influence of the Roman and manorial systems, no trace of them is recognizable in the present arrangement, which may, however, have been facilitated by the fact that the one-field system—according to Seebohm—was in vogue in the region. We may regard the Flemish arrangement as a complete dissemination, but it must be remembered that the *close* settlement of the region was brought about by the conscious rise of Belgian agriculture in response to internal economic conditions and foreign relations. The whole of Flanders exhibits to a remarkable degree the effects of human occupation in the restraint and artificial modification of Nature.

Linear Dissemination: Landrecies

The country in the neighborhood of Landrecies affords an example of a linear dissemination which is none the less complete and is very striking, especially as the predominant formation is calcareous. This area lies to the east of the old provinces of Artois and Picardy and on the map greatly resembles them in topography. It is, in reality, a very different region. Whereas Picardy seldom rises above the 100-meter contour the relief of the present area lies between the contours of 140 meters and 210 meters. The greater elevation is not apparent, the dissection being more juvenile; and the broad, sweeping outlines of the chalk are far less pronounced. Surface water is much more abundant than in Picardy, the area being drained by a number of small, swift streams, which have a general northwesterly trend. They are the headwaters and upper tributaries of the Sambre. It is noteworthy that the average annual rainfall of Avesnes is from 800 to 900 millimeters—the same as that of Le Cateau, Arras, and Bapaume, which lie to the west. The landscape is enclosed, and distant views are only obtainable from the higher hilltops, whence the country stretches out as a gently undulating expanse of small, hedged pasture fields and orchards. Forest timber, as elsewhere in the Département du Nord, is confined to a few large areas, such as the Forêt de Mormal and the Forêt du Nouvion, an arrangement which appears to be the outcome of space economy.

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[44] Blanchard, work cited in footnote 24, pp. 420-423. A good illustration of the dissemination of population is given by Vidal de la Blache, La France (Paris, 1908), of the area round Cassel (Fig. 23).

The arrangement of dwellings is most remarkable. The numerous crooked roadways are everywhere lined with houses, which are often close together and are placed indiscriminately on the hilltops or in the valleys. They are seldom situated centrally on the holdings, which are frequently long and narrow and lie at right angles to the roads. The many places named on the map can hardly be regarded as villages, except where the intersection of roadways brings about a concentration of dwellings. The grouping might, without exaggeration, be termed linear. The explanation of it is not difficult. The white chalk (Senonian) of the regions to the west has given place to an argillaceous chalk (Turonian) which, as in England,[45] is less suitable for agriculture but yields here a sufficient supply of shallow ground water, provides excellent pasture, and is suitable for pome fruit culture. The local occupation is hence dairying varied with fruit growing; and the dwellings are so placed that the handling of farm products is reduced to a minimum. As in Flanders, all traces of the manorial system have been obliterated by a subsequent readjustment. The area extends somewhat beyond the limits of description and resembles the small Belgian region of the Pays de Herve.[46]

Incomplete Dissemination: Cornwall

Cornwall exhibits a dissemination which is not complete but which has advanced considerably beyond the partial stage. It is a country of strong, though not of rugged, relief. Its picturesque hills sweep from an embayed coast, abounding in drowned valleys, up to the high, rounded granite moors carpeted with gorse and heather. Its streams and wooded valleys are numerous and small, and the roads are like switchbacks. From high positions it spreads out a rolling expanse of greenery, divided into innumerable small areas by sinuous lines of stone walls, overgrown with brambles, hazel, dwarf oak, and a multitude of small flowering plants. The retarded denudation has resulted in a softening of general outline, slight aggradation of the valley floors, silting up of the headwaters of harbors, and a depth of good soil over the predominant, steeply inclined Devonian grits and soft slates. The climate is mild and maritime, with much wind and frequent rains.

The population of the slate and grit areas is purely agricultural, practicing mixed farming, while that of the granite areas and their vicinity is occupied in mining tin and china clay. Around the coast there is an important maritime element. The few large towns are on the coast or at the headwaters of harbors; the distribution over the whole country is hence fairly even. We are here concerned chiefly with the agricultural population of mid-Cornwall. True villages are few and far between. The usual so-called village is only a small, loose nucleus; and the greater number of names on the map apply to estates or farmhouses. It is probable that many such names are records of villages which existed formerly. They recall the place names in the Landrecies area. The arrangement of the population is a thin, fairly even dissemination with an occasional village. The houses are situated in positions of convenience on the farms, which vary in size from 80 to 400 acres, 120 acres being about the average. The houses are half a mile or more apart, except in the mining areas, where small rows of miners' cottages occur. There is no habitual selection of low sites, although there are sometimes limits to the supply of ground water. There is a large amount of common land and wooded land, but its distribution is such that it does not often modify the general arrangement. The original settlement of Cornwall was under the tribal system, which later gave way to the manorial system of which the estate and an occasional lonely church or place name are the present day representatives. Voluntary enclosure has brought about the present state of affairs. The system of rural land tenure today is one of leasehold, frequently for a number of lives, i.e. a farm is leased to a family for three or four generations. This system brings about a permanence of boundaries which is well expressed by the universal stone walls, known locally as hedges. This has perhaps retarded the tendency to complete dissemination, but it must be borne in mind that Cornwall is a thinly populated country. The survival of certain villages may be ascribed to the fact that the maorial population of the country consisted largely of cottars and bordars, and even at the present day the farm laboring class is a large one.

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[45] McConnell, *op. cit.*

[46] Leriche, *loc. cit.*

ENFORCED DISSEMINATION: THE BALTIC PROVINCES

A striking example of enforced dissemination is seen in the Baltic countries of Esthonia, Livonia, and Courland, which together constitute a region of isolated farms. Dissemination in Courland dates from the seventeenth century. In these districts it has been brought about by the systematic action of the nobles of German origin, especially since the liberation of the serfs (1816–1819). Recognizing dissemination as the most advantageous form of occupation of the land, they proceeded in thorough Teutonic fashion to encourage or if necessary to force their tenants to break away from the old order, with complete success.[47]

Causes and Correlation

From the above consideration of various arrangements it would appear that definite grouping of rural populations is a conscious human response to, rather than an actual physiographic control by, a number of factors in each region, chief amongst which are the following:

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[47] Woeikof, *loc. cit.*

1. The type of pursuit to which the area is best adapted.
2. The nature of the ground water supply, rainfall, and surface water.
3. The quality of the soil.
4. The minimum size of holdings.
5. Space economy.
6. Any special local physiographic conditions.
7. The topography of the region, the effect of which is relatively slight.

It is possible to correlate freely developed arrangements to some extent with human regions,[48] village survivals, for example, being somewhat characteristic of the zone of effort while disseminations tend to occur in the zone of increment; but, as has been indicated, the factors which influence arrangement are so numerous that only the more extreme types are likely to exhibit any extensive development or broad distribution.

On a previous page it was stated that the various arrangements are not capable of systematic classification; nevertheless the following table was found extremely useful by the writer and is an attempt to express the relationships between the arrangements which have been recognized and their response to geographic environment. It is a recognition of system rather than an attempt at classification, as which it would be open to serious criticism. An American ranch, for instance, may really correspond to a wet point village; and a wet point village may, in turn, be also a strong point village. Any of the recognized forms of villages may occur under the heading "regions of diverse physiographic elements," and the vertical distribution of certain wet and dry point villages is not taken into account. Again, disseminations are linked with the zone of increment; but the Nile Delta, which is a typical zone of increment, has not developed a dissemination for very obvious reasons. The table does, however, bring out clearly the important fact that the human groups are the true subject of study, rather than the assemblages of dwellings by which the arrangement of the human groups is expressed.

THE CAPACITY OF RURAL DISTRICTS

The study of natural regions and the arrangement of their rural populations is a matter of considerable importance especially in old and densely populated countries. There is necessarily a limit to the capacity of a region, and efforts have been made at different times to estimate the number of inhabitants a country will support.[49] This will depend largely on the factors enumerated in the foregoing section and on the climate. As an area begins to approach its capacity, space economy will increase in importance and will react on the minimum size of holdings. This is already in evidence in Flanders and is becoming important in the Nile Delta.

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[48] Fleure, article cited in footnote 30.

[49] A. P. Brigham: The Distribution of Population in the United States, *Geogr. Journ.*, Vol. 32, 1908, pp. 380–389; reference on p. 387.

AGGLOMERATIONS

Sedentary

Semi-sedentary
(borders of zone
of difficulty)

Mobile
(of hot, subarid
and arid lands)

Small towns

Strong point
villages
(zone of strife)

Village communities
(tend to survive in
form in zone of effort)

Villages
(not necessarily surviving
forms of village communities)

Villages

Hamlets

(Of less fertile parts
of newer lands)
Ranches (U.S.A.)
Haciendas (Mexico)
Stations (Australia)

(Of regions of very
strong relief, and borders of zone of hunger)
Food point villages

Lime land villages
Marginal girdle villages
Dry point villages
Wet point villages

(Of regions of
diverse physiographic elements)

PARTIAL AGGLOMERATIONS

DISSEMINATIONS

Primary
(of the newer lands)

Secondary
(tend to develop in zone of increment)

Voluntary

Enforced

Dugard has shown[50] that a state of equilibrium exists in the Marrakesh region of Morocco between the number of inhabitants and the amount of arable land; and Breadnell states (*op. cit.*) that in the oases of the Libyan Desert there is a close correspondence between the population and the water supply. The necessary statistical study is rendered very difficult in the estimation of capacity, as administrative units rarely correspond in any way with natural regions. The only method open to the geographer is to make a statistical study of the smallest administrative areas of the country under consideration and to regroup them subsequently in such a manner that they will correspond as nearly as possible to the natural regions. The great difficulties of the subject have been examined and stated by Tronnier.[51] Such study is of great economic utility, however, and reveals in a startling way the reasons for the unnecessary depopulation of certain areas.

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[50] Henry Dugard: Le Maroc de 1917, Paris, 1917.

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[51] Richard Tronnier: Beiträge zum Problem der Volksdichte, Stuttgart, 1908.

THE ENVIRONMENTAL FACTORS IN THE DISTRIBUTION OF ANIMALS

By Alexander G. Ruthven
University of Michigan

It is now recognized that American students of zoögeography are sharply divided into two schools on the interpretation of the distribution of the North American fauna. One group holds to the life-zone theory, with its fundamental tenet that the fauna and flora are grouped into transcontinental zones by the effect of temperature, the northward distribution of terrestrial animals and plants being governed by the sum of the positive temperatures for the entire season of growth and reproduction, the southward distribution by the mean temperature of a brief period during the hottest part of the year.[1] The other, and much the smaller, group believes that the facts of distribution do not indicate zonal distribution and that the facts of physiology and ecology do not warrant the expectation that given intensities of any one environmental factor will be found to exert a predominating influence upon the distribution of faunas.

It should be recognized that this difference of opinion and viewpoint at least augurs well for the advancement of our knowledge of the geographic factors; for, while it is well to draft theories on the basis of available facts, it is equally desirable that these theories be subjected to a most searching criticism. Unfortunately, there is reason to believe that among the students who have adopted the life-zone theory there are those who are considering as absolute truth that which is merely the accepted, and possibly erroneous, belief predominant at the present time and others who are unduly impressed by the fact that the theory has been adopted by an active and important government bureau.

Circumstances Giving Support to the Life-Zone Theory

There are other reasons, however, for the wide acceptance which the theory enjoys. Analysis of the geographic factors is proceeding very slowly; distribution of individual species is often limited to the north and south or connected with altitude in a way that suggests temperature control; temperature and other climatic conditions are important physiological agents and vary in a rather definite way with latitude, longitude, and altitude; data on the facts of distribution are still very limited; and the methods employed by advocates of the life-zone theory yield results which apparently confirm the theory. It need not be argued that the objections to the theory, which concern both the facts and their interpretation, should not be lost sight of but may with propriety be emphasized and reiterated until satisfactorily met.

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[1] C. Hart Merriam: Life Zones and Crop Zones of the United States, *U. S. Dept. of Agric. Biological Survey Bull. No. 10*, Washington, D. C., 1898, p. 54.

OBJECTIONS TO THE LIFE-ZONE THEORY

Briefly stated, some of these objections are that the distribution of species apparently does not correspond to the accepted life zones as often or as nicely as would be expected; ecological studies yield an increasing amount of evidence that environmental factors other than the climatic ones may play an important rôle in distribution; and the data of physiology lead to the conclusion that a change in any environmental factor may make living conditions impossible. If these objections cannot be answered, the life-zone theory can continue to be held only by those who fail to resist the appeal of a dogmatism supported by extraordinary authority but largely based upon facts to which it is unrelated.

As has been intimated, there is an apparent zonal distribution of animals. It is a matter of common observation that as one ascends high mountains or journeys across the country from north to south or in the opposite direction certain species of plants and animals give way to others, and because the ranges of several conspicuous forms are frequently interrupted at about the same places it is the practice to consider the intervening area as a faunal region or zone. It is pertinent to inquire, however, whether the zones may not apply principally to the conspicuous forms; or, more broadly, one may ask what proportion of the organisms reacts to the changing conditions at the zonal boundaries.

DIFFERENT RANGES IN THE SAME AREA

Very little study is needed to reveal the fact that the forms in the same area usually have different distributions; that is in a given region many species or subspecies fall short of, or exceed, the ranges of the conspicuous forms which serve as an index to the zones. It is not necessary to give specific examples, since the statement will not be controverted. Indeed it is definitely admitted in at least one report based on the life-zone theory, for, referring to the distribution of Texas animals, Bailey[2] states: "It [the Lower Sonoran Zone] is characterized by the following species, some of which fill the subdivision and are restricted to it, while many more are restricted to definite areas within its limits, and still others range beyond through one or more of the other zones."

It is believed that when the entire fauna is considered almost every region will appear as a transition area, the fauna being composed of three elements; forms which do not range beyond the area in a given direction, forms which do not range beyond it in the opposite direction, and forms

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[2] Vernon Bailey: Biological Survey of Texas, *North American Fauna No. 25*, Biological Survey, U. S. Dept. of Agric., Washington, D. C., 1905, p. 26.

DISTRIBUTION OF LIZARDS AND SNAKES, DAVIS MOUNTAINS REGION, TEXAS

Altitudinal Distribution	Species (Italicized forms rare or secretive in the region)	Total Number of Species 33	More Common Forms in	
			Western Texas 24	Texas 25
Confined to lowlands below 3,600 feet on north (Lower Sonoran zone)	Cnemidophorus tessellatus tessellatus *Leptotyphlops dulcis* *Elaphe subocularis* *Elaphe laeta* *Lampropeltis splendida* *Ficimia cana* *Hypsiglena ochrorhynchus texana* Natrix sipedon transversa (a) Thamnophis proximus (a)	9	3	3 or 12%
Confined to mountains above 4,200 feet on north (Upper Sonoran zone)	Uta ornata (b) Plestiodon brevilineatus (b) *Plestiodon guttulatus* *Salvadora grahamiae* *Heterodon nasicus* (c) Thamnophis eques (b) Crotalus molossus	7	4	1 or 4%
Common to lowlands and mountains—both zones (*known to occur at least as high as 5,000-5,800 feet)	Coleonyx brevis *Holbrookia maculata maculata (d) *Holbrookia texana *Crotaphytus collaris baileyi (e) *Sceloporus torquatus poinsettii (e) *Sceloporus consobrinus consobrinus *Phrynosoma cornutum *Phrynosoma modestum *Cnemidophorus grahamii *Cnemidophorus sexlineatus *Cnemidophorus gularis *Coluber flagellum flagellum *Coluber taeniatus girardi *Thamnophis marcianus *Pituophis sayi Crotalus atrox *Crotalus lepidus (d)	17	17	21 or 84%

(a) Conspicuous habitat preference (semi-aquatic forms).

(b) Found in Lower Sonoran zone elsewhere in Texas (J. K. Strecker: Contributions to Texan Herpetology, *Baylor Univ. Bull.*, Vol. 12, No. 1, Waco, 1909).

(c) Recorded as occurring in Lower Sonoran zone in Texas (Bailey: Biological Survey of Texas, *North Amer. Fauna No. 25*).

(d) Recorded as occurring in Lower Sonoran zone in western Texas (Bailey, *op. cit.*).

(e) Conspicuous habitat preference (saxicolous forms).

which range beyond it in both directions. This general fact is concealed or its importance minimized by advocates of the life-zone theory by the practice of listing the species by zones. Yet it cannot be ignored, for to characterize zones by forms which do not approach their boundaries, or which exceed their limits, certainly does not throw light upon the authenticity of the divisions.

Need of Critical Distributional Studies

It is necessary to show that the zones express, at least with reasonable accuracy, the ranges of an unusual number of forms, if they are to have significance relative to the fauna as a whole. Unfortunately, but little attention has been given to conditions in the critical areas at the boundaries of contiguous zones, but at least it has not been shown definitely that a large part of the fauna of what are transition regions in the life-zone classification reacts to the particular changes in the one condition which is supposed to mark the common boundary of zones. As a contribution to this problem the writer offers the results of a critical study of the distribution of the lizards and snakes on the northern side of the Davis Mountains, Texas, where there are, according to the United States Biological Survey, two zones, Lower Sonoran and Upper Sonoran.

A Distributional Study from the Davis Mountains, Texas

In analyzing the facts of distribution set forth in this table it should be recognized, although this is not generally done, that the rare or secretive species are not significant and that their presence in statistical summaries is misleading and increases the chances of error already great enough from lack of data. The table shows that of the more common forms less than 30 per cent appear to be peculiar to particular zones if our knowledge of the distribution of the forms in western Texas is alone considered, and but 16 per cent if data on the distribution in a wider area are admitted. That is the ranges of only 16 per cent of the forms are limited in the region of the common boundary of the zones.

The arrangement of the forms in the table cannot be attacked on the ground that zonal boundaries are not exact and that the list of forms common to both zones has been increased by the inclusion of forms which only enter the lower part of the Upper Sonoran zone or the opposite, for a transition zone of 600 feet has been allowed. All of the species found in both areas are wide-ranging forms on the lowlands, and at least fifteen of the seventeen forms found in both zones have been found at the high elevations in the Upper Sonoran zone of 5,000–5,800 feet. It is admitted that the information is not complete because much is yet to be learned about the fauna, but it may be pointed out that life zones have been mapped for most regions on relatively less data than those used in this study, and, as the list of species evidently represents practically all of the common forms of the region, there is no reason to believe that a greater response on the part of the fauna to the differences in conditions between the two zones will be discovered.

Any consideration of the possible factors in zoögeography must now take cognizance of the increasing amount of data which show that environmental factors other than the climatic ones control distribution and may even cause apparent zonal distribution of some forms. Thus Newman and Patterson[3] have found that soil controls the local distribution of the lizard *Sceloporus spinosus floridanus* in a region in Texas, and the writer has shown that the presence of rocks on the mountains and of fine soil in the valleys causes a differentiation in the distribution of several reptiles in Nevada into mountain forms and plain forms.[4]

It is admitted that when the ranges of a number of forms are limited at a certain place climatic factors may be the operative ones, but it is claimed that data on distribution are not sufficient to establish this fact. On the other hand, it is sometimes possible to demonstrate the occurrence of other geographic factors from the data of distribution, particularly if animals found in two zones but having a principal distribution in one region or the other are selected. The conditions in the Davis Mountains region (southwestern Texas) illustrate this point.

Ecological Factors as a Distributional Control in the Davis Mountains

Two of the species found in both zones (*Crotaphytus collaris baileyi* and *Sceloporus torquatus poinsettii*) are distinctly saxicolous in habits. These forms are common in the mountains but so rare on the adjacent hills and plains as to be easily overlooked. That climatic factors have little to do with this distribution, however, is clearly indicated by the fact that the species are relatively abundant on the plains in the few places where there are large rocks or small rock exposures. In other words the difference in the abundance of these species on the mountains and plains is evidently due to their choice of habitat and to the fact that the rocks have been largely destroyed or buried in the region adjacent to the mountains. It is also suggestive that *Crotaphytus collaris baileyi*, which is less of a rock climbing form but commonly lives beneath rocks, is more abundant and widely distributed on the plains than is *Sceloporus torquatus poinsettii* which is a strictly scansorial form. This would be expected from the difference in habits, since loose rocks are found later than cliffs in such a geographic change. It is not too much to expect that other less saxicolous mountain forms will also be found to be limited to the mountains because their habitat is not represented on the lowland; and it may be added that two of the lowland forms, the semi-aquatic snakes *Thamnophis proximus* and *Natrix sipedon transversa*, have been found only on the larger bodies of water, making it possible that lack of food in the small mountain streams excludes them from the mountains. While the explanation of the distribution of these snakes is only a suggestion, it is a logical one in the light of the behavior of the saxicolous forms. It can receive confirmation, however, only from experimental studies.

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[3] H. H. Newman and J. T. Patterson: Field Studies of the Behavior of Lizard *Sceloporus spinosus floridanus*, *Bull. Univ. Texas*, No. 137 (Sci. Ser. No. 15), Austin, 1909.

[4] A. G. Ruthven: An Interpretation of the Distribution of the Reptiles in Maggie Basin, Nevada, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 948–952.

Exception will also probably not be taken to the general statement that habits and habitats may control distribution. Thus Bailey[5] has stated that "In eastern Texas many species stop short of filling the whole humid area, and when their ranges are carefully mapped are found to be absent from, or in fewer cases to be restricted to, some of the following nonforested sections: the Grand and Black prairies of the Fort Worth and Dallas region; the coast prairie; coast marshes; islands and beaches." But it has been argued that such ecological data apply to local differences in distribution and that the differences in the environments are not those which prevail over a sufficiently large area to affect the whole range of a species. This is likely to be true, but if the facts are sufficient to show that such zonal distribution as occurs on mountains may not be due to climatic factors they certainly weaken the general theory to this extent.

Comparison of Phytogeographic and Faunal Divisions

There is, moreover, a larger aspect of the problem to be considered. If the distribution of the species of particular genera of land animals is examined, it is clear that the ranges are more liable to be affected at the place of contact of vegetation regions than on boundaries of life zones. Phytogeographers recognize divisions of the flora of North America which do not harmonize with life zones but more nearly correspond to physiographic regions.[6] It is believed to be significant that the species and subspecies of many genera of animals with terrestrial habits are apparently associated with these divisions, or, to express the facts more correctly, the forms of a genus frequently respond to the changes in conditions at the boundaries of vegetation regions by not going beyond them without change. It is not evident that comprehensive faunal divisions can be recognized on this basis, but it is apparent from the monographic revisions of genera which have been published that the boundaries of the vegetation regions are critical areas affecting a considerable number of forms. This would be expected on the theory that several factors may control distribution for, since there are a number of changes in the environments at these points, a larger number of species is affected than would be the case if only one factor were changed. If this explanation is true it would indicate that detailed studies of environmental conditions over large areas and of the physiology of the organisms dwelling therein will show that, as on mountains, the variation in any factor may control distribution and that the more numerous the factors which are changed the greater will be the number of species affected.

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[5] *Op. cit.*, p. 18.

[6] Compare the map of vegetation areas of the United States by Forrest Shreve, *Geogr. Rev.*, Vol. 3, 1917, opp. p. 124.

Physiological Ecology in Relation to Distributional Study

Physiological ecology is an aspect of zoölogy which has but recently come to receive the attention it deserves. As the study of the physiological relations existing between organisms and their environments, its data will provide a basis for the interpretation of the factors of distribution, and for the most part this interpretation must await the accumulation of ecological data. For this reason it is not possible, at present, as has been said, to prove that climatic factors are not the operative ones in controlling the distribution of forms which are confined to a particular region. However, since the effect of the inorganic contacts is largely physiological, we may well be guided by physiological facts in drafting our theories concerning the geographic factors and their operation. Physiologists have shown clearly that while temperature is an important physiological agent there are many other agents any one of which may be unfavorable at certain intensities. In other words, each environmental factor has an optimum intensity and unfavorably affects the animal at intensities either above or below the optimum.

Furthermore, it has been established that there are great physiological differences between species, both the optimum intensity of agents and the range of tolerance being characteristic for different forms. It is not necessary to illustrate these general physiological principles, but it is to be understood that the life-zone theory—that particular intensities of climatic factors exert a controlling influence on the distribution of many forms—is based on the assumption that many animals, or at least many terrestrial vertebrates, are physiologically similar in one respect, whereas there is no supporting physiological evidence for this assumption. If temperature changed suddenly and so radically as to surpass the range of tolerance of a large number of animals the life-zone theory would be more logical, but climatic variations are as a rule gradual.

Environmental Relations a Complex

From the ecological and physiological viewpoint it is necessary to consider the environment as a complex "the sum of all the contacts which an organism or a group of organisms establishes with the forces and matter of its surroundings, either organic or inorganic."[7] If the environmental relations of an animal are a complex it must follow that the variation of any feature of the environment may alter the whole in a way disastrous to the existence of the form and may cause extinction or function as a barrier to migration or ecesis. This conception of the nature of the environmental relation together with the physiological diversity of animals negatives the expectation that any one factor will ever be found to account for the present distribution of a fauna. The apparent zones become in reality only the habitats of a limited number of forms.

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[7] E. C. Case: The Environment of Vertebrate Life in the Late Paleozoic in North America: A Paleogeographic Study, *Carnegie Instn. Publ. No. 283*, Washington, D. C., 1919, p. 40.

It is possible that changes in temperature and moisture, either directly or through effects on the flora, are the factors which most often change the environments sufficiently to control the north-and-south and the east-and-west distribution of forms on great continents like North America, but this remains to be proved. Furthermore it is not evident that the considerable number of physiologically different forms composing the fauna responds to the same changes in the intensity of an environmental factor so as to permit of its division into zones. In ignoring the physiological and ecological data it is apparent that adherents of the life-zone theory are falling into the error of some anthropogeographers who, as Miss Semple has put it, "are prone to get a squint in their eye that makes them see one geographic factor to the exclusion of the rest; whereas it belongs to the very nature of physical environment to combine a whole group of influences, working all at the same time under the law of the resolution of forces."

In conclusion it may be pointed out that since the life-zone theory was first proposed the work of its advocates has largely been the listing of the faunas of the several zones and that nothing has been done to determine the effect of the assumed or other possible geographic factors. It needs to be understood that distribution cannot be explained by the mere mapping of the extent either of hypothetical faunal divisions or of species. The determination of the environmental factors is largely a physiological problem, and the data should be habits, habitat preference, analyses of conditions in the habitat, exact range, and the results of experiments upon the effect of altering the intensities of environmental factors.[8] Only harm can result from listing the forms by zones, for significant details of distribution are concealed, and the life-zone theory receives apparent but not real confirmation.

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[8] The classified list of ecological problems given by Barrington Moore (*Science*, No. 1307, Vol. 51, 1920, pp. 67–68), while incomplete, may be accepted by the student of zoögeography as a guide to the problems whose solution will throw light upon the environmental factors of distribution.

THE PENCK FESTBAND: A REVIEW*

By W. M. Davis

The Man and the Volume

Let the memories of four painful years be set aside as far as possible while this well-earned tribute to a great geographer is reviewed. The volume opens with an address from one hundred and sixty-three of his former students—the list would have been significantly longer if the events of those obtrusive years had not excluded a number of non-Teutons—an address glowing with gratitude for the instruction and inspiration received by the disciples from their master and with enthusiasm for the subject which he has, in their opinion, done so much to raise to the rank of an independent science. They admire the broad range of his studies, developed chiefly in different phases of physical geography and extended into human and political geography; and they properly take pride in his numerous activities as teacher, organizer, explorer at home and abroad, and prolific writer. The many geographers of all countries who have had to do with Penck at international congresses and on distant journeys will recognize the justice of this tribute; for during the last thirty years his has been one of the most active and attractive minds in every gathering that he has joined. His scientific originality and his genial personality have been equally enticing. He used to be liked as much as admired, but during the war some of his statements have lessened the esteem formerly felt for him: into that matter we do not enter farther here.

The *Festband* contains twenty-two essays by as many writers and thus covers a wide variety of subjects. Morphology of the lands takes the lead with eleven; anthropogeography has three; hydrography and geographical education, two each; and climatology, economic geography, cartography, and method are each allotted one. All the contributions are serious, advanced studies. They give little indication that a fearful war was raging while they were written and published, although the otherwise surprising fact that only one essay deals with exploration in a distant region is perhaps thus to be explained. The effect of the war may, however, be recognized in having given opportunity during the German occupation of Constantinople for a study of the currents of the Bosporus by Merz and in having tempted Krebs, in the introductory phrases of his anthropogeographic study of the Balkans, to make the somewhat premature statement that the opening of that region is among the most valuable results which the war has brought to "us Germans." All the essays deserve separate consideration; the present writer reviews three regional physiographic studies of limited districts in central Europe on the later pages of this article.

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*Festband. Albrecht Penck: Zur Vollendung des sechzigsten Lebensjahrs gewidmet von seinen Schülern und der Verlagsbuchhandlung. xii and 438 pp.; maps, diagrs., ills. (Bibliothek Geogr. Handbücher.) J. Engelhorns Nachf., Stuttgart, 1918.

Domination of the Geological Standpoint

A careful study of these three essays and a general examination of the others suggests the question whether full warrant can be found for the assertion in the dedicatory address to the effect that Penck has raised geography to the rank of an independent science; for, like his own work as exhibited in numerous publications, many of the essays in the *Festband* are by no means freed from domination by geology. Just as the masterly investigation, "Die Alpen im Eiszeitalter," conducted by Penck jointly with Brückner of Vienna, is essentially a geological study, however interesting and valuable its geographical by-products are, so the work of his students as illustrated by several essays in the *Festband* appears to be concerned more with the evolution than with the description of land forms; and the evolution is treated largely from a geological standpoint rather than directed to a geographical end. Furthermore, not a single essay is devoted to full-fledged geography in the sense of giving a complete or regional account of a limited district, beginning with its physiography and climate and ending with its human inhabitants. The anthropogeographical study of the Balkans, above mentioned, gives, as is usual in such essays, no sufficient physiographic basis for its conclusions; and conversely the several morphological essays stop with land forms and do not go on to their human consequences.

It is indeed disappointing that a volume which celebrates the achievements of a leading European geographer should not contain at least one simple, direct, and competent study in regional geography; simple, in the sense of omitting all irrelevant geological and historical matter, however interesting such matter may be in itself; direct, in presenting the essentially geographical results that are reached by preparatory analytical discussions, while omitting the analyses and discussions that lead to the results; and competent, in showing a broad grasp of all phases of geography instead of specialization in one or more of its subdivisions. But, disappointing as the absence of such studies is, the same criticism would probably apply to the work of students trained under other modern teachers: their pupils too seldom become full-fledged geographers in the sense above indicated. Exception should be made, however, in favor of the late Paul Vidal de la Blache; his disciples have produced a good number of admirable regional volumes, although the authors of some of them, following the habit of gheir master, draw more largely upon history than seems desirable in pure teography.

The volume here reviewed is also disappointing in giving so much attention to the science of investigation as not to allow sufficient cultivation of the art of presentation. Even in the mere matter of book making the needs of readers are not enough considered; for most of the essays are not well divided into sections, page headings give only the author's name and the title of his essay, and there is no index. In so far as the morphological essays which occupy half of the volume are concerned, they are not notable for clearness of exposition. All the essays reflect an enthusiasm for research, and that is excellent; but their authors do not seem to have devoted much thought as to how their results could be best set forth or as to how the essentially geographical elements of their results should be given due prominence. This is shown by the greater attention frequently accorded to invisible past processes than to their visible present products, as well as by the scarcity of outline maps and diagrams and by the commonplace quality of such diagrams as are included. The volume is not so great a product, geographically measured, as might have been expected.

The Harz Foreland

Three morphological essays are here selected for review, as being more in line with Penck's own studies than the essays on other subjects. One of them treats the southern foreland of the Harz Mountains, the second discusses the Vienna basin, and the third describes the Podolian upland in Galicia. The first, by Gisela Frey,[1] explains that the upheaved fault block of the Harz in central Germany, composed of deformed and greatly degraded ancient rocks, is bordered on the south by the broad and shallow Thuringian syncline, around which a resistant limestone forms an irregular cuesta. The northern arm of the cuesta trends to the east; the southern to the southeast; thus the two diverge eastward with the gentle pitch of the synclinal axis, and unite westward and are there extended in isolated tables along the gradual ascent of the axis toward the valley of the Weser. The weaker underlying strata between the northern cuesta arm and the Harz block are excavated in an open east-west depression, about 25 kilometers wide; this is the foreland of the Harz described in Frey's essay.

STRUCTURE AND DEVELOPMENT

The foreland is treated under three headings; structure and development, hydrography, and local features. The structure is more complicated to the east and west than on the south of the middle Harz; hence the central district may be taken as the simple type from which the eastern and western extensions depart in various ways. The structural description of the foreland and the adjoining uplands is highly geological in that it discusses the dates at which various complications of structure were produced and at which a peneplain was afterwards developed over the whole district. Half a page is given to prove that the peneplain is Eocene or older, thus emphasizing a purely geological problem, which, however important it may be in a morphogenetic analysis, has no proper place in a physiographic description. A later cycle of erosion, introduced by regional uplift, is now in an advanced stage; thus the hard and soft strata, which had been broadly truncated in the peneplain, again express their resistance or weakness in surface forms. The forms thus sculptured by normal erosion are more or less covered both by gravels and sands spread out by proglacial streams, and also by loess laid over them by the wind.

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[1] Das südliche Harzvorland: Ein Kapitel aus einer Landeskunde, *Festband*, pp. 135-159.

The hydrography is set forth chiefly in its existing condition with little regard to its development. The description of individual streams sometimes expresses an empirical structural relation, as where streams are said to be anticlinal or cataclinal; sometimes a genetic relation, as where they are said to be consequent or subsequent. The difference of treatment appears to be accidental rather than systematic and intentional. A closing paragraph briefly states that the present stream courses have been developed by erosion through a Tertiary cover which formerly overspread the now dissected or destroyed peneplain, and that various captures and adjustments to weak strata have taken place; but the visible landscape features associated with the captures and adjustments are not clearly set forth.

Local Features

Reference may be made to a few of the local features as samples of the rest. South of the central foreland, which is unsystematically dissected in low relief, rises the northern arm of the above-described cuesta, there bearing the names of Dün and Hainleite; it is maintained in somewhat irregular outline by the resistant Muschelkalk with a subordinate overlapping cuesta on its back slope. Here the dip of the cuesta-making strata is moderate and the cuesta upland is broad enough to retain traces of the ancient peneplain. To the east the dip increases, apparently because a small Harz-like mass, known as the Kyffhäuser, is upheaved near by. It may be noted in passing that the northern face of this mass is briefly described as a *Bruchstufe* or fault scarp; but, as the upheaval of the mass antedates the peneplanation of the region, the scarp must be due to erosion, not to faulting; and it therefore deserves a distinguishing name, such as fault-line scarp; its height is not a measure of the original displacement but of the difference of altitude between the uplifted peneplain and the present lowland. As if deflected by this uplift the cuesta turns to the southeast, and by reason of the steepened dip of its determining strata it is transformed into a narrow ridge, the Schmücke, across which the Unstrut, the chief river of the synclinal basis, flows out to the northeast on the way to the Saale and the Elbe.

To the west of the central foreland there is no exterior upheaval like the Kyffhäuser, and the strata outside of the main cuesta lie nearly flat;

hence the foreland here widens as the border of the Harz turns to the northwest. In the broadened space thus opened the Dün is fronted by two scarped uplands, maintained by residual patches of the cuesta-making limestones which are there gently warped down in faint structural basins; the smaller and eastern upland is the Bleicheroder Berg, the larger and western is the Ohmgebirge; farther to the northwest the scarped edge of the Göttingen upland is of similar origin. Just north of the Ohmgebirge the lower land is interrupted by a north-trending ridge, which represents a narrow down-faulted block, now standing in relief because the cuesta-making limestones are there depressed nearly to the level of the worn-down lowland surface. Singularly enough this ridge, known as the Klien, although it represents a structural depression, now forms part of the main divide between the Elbe and the Weser river systems. Farther west the frayed-out end of the Dün is extended at the apex of the main syncline by isolated outliers, influenced by unspecified structural complications.

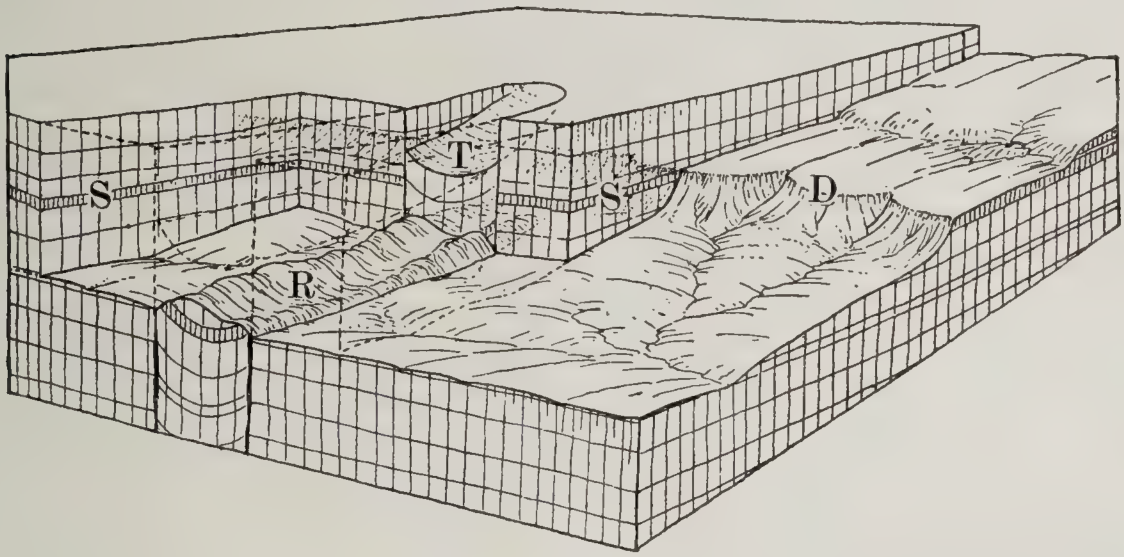

FIG. 1—The Klien, R, north of the Ohmgebirge, D, looking southeast. The Klien is a down-faulted block of synclinal structure, now standing in relief in virtue of its limestones being harder than the adjoining shales.

CRITICISMS

In comment on this article it may be said that the author shows abundant familiarity with the field described and a trained competence in analytical discussion; but the pages on structure and development are, as above noted, too geological for a properly modernized geographical essay. They show, moreover, various indications of what may be called an "imperial provincialism"; that is, a tacit and probably unconscious assumption, often characteristic of untraveled geographers, to the effect that all the world must of course be acquainted with the general geology and geography of so important a region as their home area. Thus it is here assumed that every one must surely know that the Buntsandstein underlies the

Muschelkalk. The essay is thereby made less useful to the world at large than it would have been if the manner of treating local matters had been given what may be called "international consideration."

Need of Illustrative Diagrams

The description of areal subdivisions wisely avoids the introduction of village names as guides to the location of physical features; but, in using certain larger features as a means of locating various smaller ones, the text becomes fatiguing not to say obscure to readers who are not already familiar with the Eichsfeld, the Goldene Aue, the Windleite, and the Finne. Here the complete absence of graphic aids is lamentable. It may indeed be seriously questioned whether an essay in which the location of detailed features is thus treated in terms of little known larger features can be regarded as satisfactory from the reader's point of view. Several illustrative diagrams for special areas should be included, and at least one simplified outline map for the whole district, about such as the author could draw on a blackboard from memory, with the leading areal subdivisions and physiographic features indicated in as much detail as most readers will care to remember. By using such an outline and its subdivisions as guides all necessary physiographic items could be concisely located by the author and easily apprehended by the reader. The little extra labor expended in drawing such a map would be abundantly repaid by the gratitude of many a distant geographer; and it is good scientific economy for an author to undergo the labor, once for all, of thus making his pages easily intelligible so that many readers shall be spared the fatigue of trying to make out, each for himself, the meaning of obscure descriptions. Indeed, unless the author thus aids his readers their number may be smaller than he would like.

Even the greater labor of designing and drawing a diagram in explanation of so peculiar a ridge as the Klien would be warranted; for the conception and construction of such a diagram demand close attention to the facts and their meaning on the part of the author, and its interpretation yields a clear understanding to the reader. The diagram above presented, modified from an original drawn on the ground ten years ago by the late Professor Grund of Vienna, Berlin, and Prague is reproduced to illustrate the point. In this case the diagram is the more worth while because it shows that each side slope of the residual Klien is one of those physiographic rarities known as an obsequent fault-line scarp. If the author demur, saying "I can't draw," the Teutonic maxim may be administered: "You *can* draw, because you *must*." It was indeed under such disciplinary compulsion that Grund, who had not been in the habit of making similar attempts, designed his diagram during a field excursion. A year later he wrote from Prague: "I now use block diagrams frequently in my lectures and with much success."

The Vienna Basin

The essay on the Vienna basin, by Hugo Hassinger,[2] gives an elaborate account of part of a depression which lies between two extensions of the Alps, diverging northeastward on either side of Vienna. Its presentation lays a much stronger emphasis on the conditions and processes of the invisible geological past than on the conditions and forms of the visible geographical present. The treatment is advanced and detailed, the chief results of earlier studies being assumed as known in the intricate discussion to which the greater number of pages are devoted. The erudition of the author is unquestionable, but the geographical quality of his essay is for the most part obscure. Few distant geographers who begin the essay will persevere to its end.

Physical Features

Fortunately an illuminating account of the leading physical features of the district is given in the introductory pages; and from these, supplemented by reference to a good map, it may be learned that the Vienna basin, the southern part of a larger intermont depression, is a triangular area heavily aggraded and now having for the most part a plain surface. It is bounded on the west by a well-dissected fault scarp, trending north-northeast, 75 kilometers in length, by which the Alpine highlands are abruptly cut off, and is limited for 95 kilometers on the southeast by the lower Leitha range, which extends northeast toward the Carpathians. The basin is separated from the rest of the intermont depression on the north, known as the Marchfeld, by the Danube, which, entering from a narrow valley in the western highlands and departing by a short passage through the southeastern range, crosses the depression in a curved course, convex to the south, 55 kilometers in length. It may be noted that the situation of Vienna at the northwestern angle of the triangle, as well as the dimensional elements here introduced, are omitted from the essay as if they were of course known to every one; an omission which affords another illustration of "imperial provincialism." Perhaps, if the author were told that he ought to have specified the situation of Vienna in its basin for the benefit of his readers, he would have felt like Bret Harte's California miner, who exclaimed: "Didn't know Flynn, Flynn of Virginia! . . . Look'ee here, stranger, whar hev you been?" Yet it is probable that few of the world's geographers really know in just which corner of the triangular basin Vienna is situated.

Three unlike areas are distinguished. The southern angle of the basin is occupied by dry and gently sloping piedmont fans, composed of pervious gravels: here several streams follow narrowly incised trenches about 20 meters deep, leaving undissected interstream spaces covered by heaths, fir plantations, and fields devoted to precarious agriculture. A middle area is covered with detrital deposits of much less thickness. Here the larger streams from the western highlands and several smaller ones fed by springs in the gravels flow in a bifurcating network through broad meadows of moist and fertile soil, in which fine-textured deposits underlying the inwashed gravels are disclosed and in which artificial drainage ditches are required. Residual patches of the gravel cover survive in low spurs and tables, 3 or 4 meters above the meadows, occupied by grain fields. In spite of its flatness, the old manorial estates of this district present a picturesque appearance. In the north the plain is benched by the terraces of the Danube; here the gravels of the southern angle of the basin are replaced by finer deposits of a considerable thickness as a result of the basin streams having been held back by ancient floods in the main river. The later entrenchment of the terracing Danube and the incision of many side valleys and ravines by the tributary streams give this area a hilly surface with a relief of from 50 to 150 meters. The chief stream of the basin, the Leitha, is pushed by the detrital fans from the higher western highlands close to the lower range on the southeast, and is peculiar in making its way through that range by an independent passage, 5 kilometers south of the Danube.

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[2] Beiträge zur Physiogeographie des inneralpinen Wiener Beckens und seiner Umrandung, *Festband*, pp. 160–197.

Criticisms: Use of Geological Terms and Explanations

The preceding paragraphs are chiefly abstracted from the first ten pages of Hassinger's essay, where many other details are to be found. The remainder of the essay is impenetrable without closer study than most geographers will care to give it. It is devoted chiefly to an elaborately analytical "history of the base level and the development of land forms in the Danube basin," in which the reader's attention is almost constantly distracted from the present and turned into the past. It abounds in the names of local geological formations, such as the Rohrbach conglomerate and the Laaerberg gravels, which can be properly understood only after a preparatory study of many special articles cited in the even hundred of supplementary references. The localities where deposition, deformation, or denudation has taken place and where various land forms occur, either within or without the Vienna basin, are inconveniently indicated by place names, of which as many as twenty may be counted on a single page. Some of the names are familiar, like Neusiedler Lake and the Iron Gate; but most of them are unfamiliar.

Nevertheless the analytical discussion here presented appears to have been conducted with competence and skill. New conclusions are announced at its close regarding the physiographic evolution of the Vienna basin as determined by various crustal warpings, for the discovery of which the author certainly deserves credit; but the discoveries are so involved with geological complications that little if any geographical significance can be attached to them as they are now stated. Moreover, the essay illustrates to perfection that exaggeration of pseudo-explanatory physiographic treatment which makes the origin of a thing more difficult to understand than the thing itself. Indeed, if such an essay as this is to be regarded as geographical, then those are justified who claim that geography is only geology masquerading under another name.

A lesson may be here learned from the practice of astronomers, who in concisely announcing the elements of a comet's orbit do not include the elaborate mathematical calculations by which the elements were determined; or from the chemists, who in briefly stating the composition of a substance submitted for analysis say nothing of all the manipulations by which the composition was learned. Let morphogenetic geographers be as geologically analytical as they like and let them publish their geological analyses in appropriate journals if they wish; but, when it comes to presenting their geographical results, let their statement be directed to the manifestly geographical object of giving a helpful account of visible landscapes.

The Podolian Upland in Galicia

Lemberg, the capital of Galicia as things used to be, lies near the mid-European divide between the head branches of the Vistula flowing northwest to the Baltic and of the Dniester flowing southeast to the Black Sea. The Podolian upland, the longest of the Ukraine interfluves, extends far southeastward from near Lemberg, between the Dniester and its nearly parallel neighbor, the Bug. The Galician part of the upland and some associated areas on the northwest are described by Stefan Rudnyćkyj[3] on the basis of field work carried on through ten years preceding the war. Several subdivisions of the region are treated separately. Their form is first described, for the most part empirically but occasionally in explanatory style; then their structure is presented in geological terms; some morphogenetic paragraphs are added. Attention is given in this review to the Galician part of the Podolian upland proper, which measures about 140 kilometers in width between its limiting rivers and which includes 180 kilometers of its total length of 500 or 600 kilometers.

Physical Features

From the lower land around Lemberg, about 200 meters above sea level, a rapid ascent is made by a ragged, northwest-facing escarpment to the head of the upland interfluve, there about 400 meters in altitude. Thence the upland slopes very gradually to the southeast. The escarpment is not regarded as a cuesta face, for it is not determined by a resistant capping formation. Some of the former tributaries of the Dniester north-

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[3] Die podolische Platte in Galizien, *Festband*, pp. 198–211.

west of the Podolian upland have been completely diverted to the Vistula; others, which head in notches in the upland scarp, have lost an undetermined measure of their former length. Hence the scarp may perhaps be the result of encroachment by lower-lying Vistula tributaries upon the upland area drained by higher-lying Dniester tributaries. The upland is composed for the most part of horizontal strata which exhibit, apparently as the result of advanced erosion in a former cycle before the uplift which prompted the river captures above noted, a gently undulating surface of low swells and shallow troughs with northwest-southeast trends about parallel to the main rivers by which the interfluve is bounded. Curiously enough it is drained for the most part by subparallel, south-flowing Dniester tributaries which cross the swells obliquely and cut them into short segments. No adequate explanation of these features is presented. Some of the segments are crowned by ruin-like remnants of reef limestones; each segment is usually higher in the northwest than to the southeast, partly as the result of unsymmetrical loess deposits. The shallow troughs lead longer branch streams from the northwest and shorter backhanded branches from the southeast, to the south-flowing rivers. Eleven of these rivers, from 40 to 130 kilometers in length, may be counted in Galician Podolia, and as many more farther southeast in Ukrainian Podolia. The members of the first group, of which the Sereth is a good example, wander in their upper courses on broad valley floors, which seem to date from the same cycle of erosion as that to which the swells and troughs owe their subdued expression. Farther down stream their courses are incised beneath the valley floors; there the streams flow in narrow meandering valleys which attain a depth of from 100 to 180 meters, with sharp-cut sides showing two terraces. The uplands are largely occupied with grainfields; villages with green gardens lie in the valleys even where they are deeply incised.

The pronounced entrenchment of the south-flowing rivers is a sequence to the even deeper entrenchment of the Dniester, which, long ago pushed away from the Carpathians by the detrital outwash of vigorous, square-branching tributaries from the southwest, now flows in a wonderfully meandering canyon, incised 200 meters or more beneath its former valley floor. The equal of this meandering canyon is hardly to be found in Europe. The river is still deepening its course and has few and narrow flood-plain scrolls; the steep walls of the valley are maintained by a hard red sandstone. The incised valleys of the larger tributaries steepen their fall as they approach the master river; the valleys of the smaller branches hang over the main canyon bottom.

CRITICISMS: NEED OF LOCATION MAPS

The above extracts suffice to show that Rudnyćkyj's article contains much matter of interest about a region little known physiographically;

but the article does not reveal a well-developed method of geographical presentation. Its descriptions are difficult to follow because, in the absence of a guide map, the names of villages and streams are used in locating boundaries and physical features. Not one geographer in a hundred—or a thousand—can use these local names to place the six areal subdivisions of the region, Roztoče, Ponyźe, Pidopil'e, Opil'e, Podnistrje, and Podil'e or Podolia proper. It is nothing less than self-deception for an author to think that his readers can follow the eastern boundary of Ponyźe, for example, when he tells them that it passes by Rudno, Hlynna, Pustomyty, Mylošovyči, Chorosno, Krasiv, Brodky, Demnia, and Mykolajiv. Even if the attempt is made to look up the place names thus used, few of them can be found on easily accessible maps, such as those in Stieler's atlas; indeed, it is difficult to find all of them, partly because of differences in spelling, among the countless other names that are given on the Austrian map of central Europe, 1:200,000, or on the larger-scale topographical sheets of Austria-Hungary, 1:75,000.

It cannot be believed that such use of these generally unknown place names to locate unknown physiographic features represents the best method of geographical description. It shows too little inventiveness because, in the absence of an outline map in the text, some plan for the verbal description of areas should have been devised in terms of contiguous triangles, semicircles, scrolls, and other readily conceivable patterns, within each of which various details might then be placed with as much accuracy as is conveniently attainable by words alone. It shows too much provincial introspection because, in the use of place names that are familiar to the author but unknown to practically all readers of his article, he fails to realize the small share of space and of attention that Galician Podolia occupies in the busy world. A much better method involves the use of an outline map as a graphic aid. In truth, when an author uses unknown place names as guides to the location of unknown physiographic features, it is tantamount to saying: "It is too much trouble for me to represent these features on an outline map or to define them verbally in terms of easily conceivable patterns; if you readers want to know where the features are, look up the guiding names on a map."

Lack of Attention to Geographic Presentation

That less attention has been paid in the preparation of this article to the art of geographic presentation than to the science of geographic investigation is manifest in various ways. The introduction of underground structure after the surface forms have been described is a curious inversion of a more reasonable procedure: for, if explanatory methods are to be employed at all, underground structures should be used as an aid in understanding the form of the surface, and hence structure should come before form. The frequent omission of details concerning the attitude, composition, thickness, and resistance of stratified formations is not compensated by the mention of their geological names; indeed, it by no means follows that such names, which have been invented by geologists for their own purposes, are the best names for the purposes of geographers. Certain passages in the text make it clear that the unlike requirements of geological and geographical presentation have not been mastered; it truly gives a learned appearance to a page to say that the marine Devonian beds which occur in southeastern Galicia have heretofore been erroneously ascribed to the Silurian, that certain strata in the upland represent the transition from the Mediterranean to the Sarmatian period, and that of the two terraces in the valleys one is young diluvial and the other old alluvial; but if the space thus occupied had been devoted to explanatory descriptions of more visible things—for example, to the reason for the oblique course of the south-flowing rivers with respect to the upland system of swells and troughs, and to specific accounts of the terraces as elements of the valley landscape—geography would have been the gainer.

Let the field work on which these geological statements are based be continued by all means; let the history of the changes that took place in Podolia during the Glacial period be worked out as far as possible, if the author's interest turns especially in that direction; but, if the author be a geographer, let all these studies and many more be pursued with a truly geographical object. Then, after the necessary field investigations are well advanced, let the geographical account of the region be freed from all irrelevant erudition so that single-minded attention shall be given to the facts of today; let these facts be presented according to some well-tested scheme, either empirical or explanatory; and let the presentation be easily intelligible, especially to readers who do not know the region, for in that class belong most of the geographers of the world. Instead of presenting the geographically useless information that the "Turon-, Emscher-, and Senonkreide" occur in Podnistje, or that certain Miocene beds in Podolia are covered with "sarmatischen Ervilien- und Serpulenkalken," the remarkable contrast in meander pattern presented by the Dniester before and after it enters the upland might have been described: in its upper course it winds freely on a broad flood plain in small, close-packed meanders, $\frac{1}{5}$ to $\frac{1}{3}$ kilometer in radius, the meander belt itself winding in somewhat larger curves; while in its lower canyon-like course, the meanders are much larger, being 1 or 2 kilometers in radius, and the river there vigorously swings around the spurs and undercuts the great amphitheaters, alternately right and left, in thoroughly competent fashion.

A Questionable Statement as to Erosion

With increased attention to these physiographic matters, correction might be made of a questionable statement in a final paragraph to the effect that, while downward erosion is still operative in the winding Dniester canyon, lateral erosion is as yet imperfectly developed; for unless this river is unlike many others of similar appearance—for example, the Seine and the Mosel—its lateral erosion, outward on each meander and down-valley on each tangent, has already exceeded its vertical erosion. Unintentional testimony for the outward expansion of the meanders by lateral erosion is given in the mention of the two terraces on the slope of the meander spurs; but nothing is said of the expectable contrast between the steeper slopes of the undercut, up-valley sides of the spurs and the gentler slopes of the slip-off, down-valley sides, although this contrast is strong enough in certain other incised meandering valleys to determine that the steep slopes shall be left to tree growth, while the gentler slopes are cleared and cultivated.

It may perhaps be objected that the foregoing pages overemphasize the importance of presentation as compared with investigation. In reply it is recognized that while original research is of course the prime essential of scientific progress, and while the scientist who conducts the research profits by its successful prosecution, the world at large will know nothing of it until it is communicated and even then will not know the truth about it unless it is communicated properly. The first requirement of investigation is that its results shall be correct and accurate; similarly, the first requirement of presentation is that its statements shall be clear and intelligible. The former promotes the increase of knowledge; the latter promotes the diffusion of knowledge. Each process should be developed to best advantage. The essays above reviewed give abundant indication that their authors were careful and competent in the conduct of their investigations. Not so much can be said as to their skill in the presentation of the results of their investigations.

THE CULTURE OF THE AMERICAN INDIAN: ITS REGIONAL DISTRIBUTION AND ORIGIN*

Human geography seeks interpretation through terms of the past as well as the present. The long continuity of local culture has been a potent factor in fostering the progress of human geography in Western Europe In contrast a cataclysmic break separates the indigenous culture of America from that of the modern western world; this undoubtedly is partially responsible for our tardy interest in human geography. Yet we may question whether the break is quite so cataclysmic as it seems at first glance.

Indian Culture in Relation to Modern Civilization

The Indian indeed has vanished, or practically so; but what of his cultural achievements; do they leave no heritage for the regional successors? Even in offhand fashion this can be answered by reference to the cultivation of various indigenous plants, first and foremost of maize. The present-day economy of the Middle West is primarily founded on maize. And the debt to this aboriginal cultivation is still growing. Modern plant breeding utilizes the possibilities of the maize of the Titicaca basin that long cultivation has developed to withstand the high altitude cold. In Dakota a student of Indian life has lately conceived the idea of training the farmer of the northwest to raise maize, in spite of the shortness of the season, by use of methods anciently worked out by the Indians of the locality.

For a more complete appreciation of the debt of our civilization to Indian culture, "too virile and too finely adjusted to local geographic conditions to be obliterated," the geographer must turn to the anthropologist. Here he will find a comprehensive study to hand in the recent work of Clark Wissler, "The American Indian." It is a result of the fruitful method of modern anthropology that "commits us to a historical and geographical point of view." Herein classification finds its basic principle in geographical distribution, for the anthropologist has learned, according to the phraseology of Marett, "to work all the time with a map of the world at his elbow."

The Culture Regions

First we have the mapping of separate cultural elements. Most tangible and objective of all are those having to do with food. The map of the distribution of staple food resources gives, in fact, the general lines on which the cultural grouping as a whole is laid down (see Fig. 1). Consideration of the sum total of cultural traits gives rise to an accepted classification of the New World into 15 cultural regions. They are shown on Figure 2. These areas, like all objective distributions, are not susceptible of rigid delimitation. A culture area indeed is defined rather by its center whose geographical position is coincident with the habitats of the most typical tribes than by the periphery. The culture areas thus defined relate to historic time. Similar archeological areas may be determined. A comparison of the two is interesting. With the exception of Central America and the eastern maize area of the United States there is very close agreement among them, suggesting that in some way a type culture is fixed in its locality. This naturally brings up the question of the influence of environment.

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*Clark Wissler: The American Indian: An Introduction to the Anthropology of the New World. xiii and 435 pp.; maps, diagrs., ills., bibliogr., index. Douglas C. McMurtrie, New York, 1917. $3.00. 9 x 6 inches.

Wissler stresses environment as the static factor. It does not produce the culture but furnishes the medium in and by means of which the culture flourishes and tends to hold it there when once rooted. The tribes occupying any of our culture areas make use of a certain number of the possibilities presented by that area and specialize in these, and they are perpetuated as social habits that resist change. Cultures appear to expand to the geographical limits of the environment in which they have originated but do not readily pass beyond. Blood and language may more easily be carried over. Until the appearance of the white man in America there were no sudden invasions of new races, and groups migrating from one culture area to another seem to have been rapidly assimilated culturally. Moreover, in regard to the regional distribution of blood and language highly interesting conclusions have been reached, though these are strongly controverted. It is asserted that the various language stocks show a grouping that tends to be coincident with that for the culture characteristics; and even the somatic type, a biological characteristic, is regarded as exhibiting a tendency to conform to the environmental area. But these tentative conclusions await further research for confirmation or disproof.

New World Origins

The ultimate goal of the anthropologist is the discovery of the origin of his subject, and here we must turn to the world map, first however recognizing a fundamental feature of the anthropology of the New World as a whole. This is its essential unity. For the higher cultures of the New World an extraneous origin has been sought: but this is not necessary. Mexico and Peru are merely the centers where the characteristic culture traits of the New World reached their highest development. Proceeding outward we may trace their fading parallels. This is true of such material traits as agriculture, metal work, ceramics; and it is still clearer in the case of the less material traits. Society is composed of the same kinds of units,

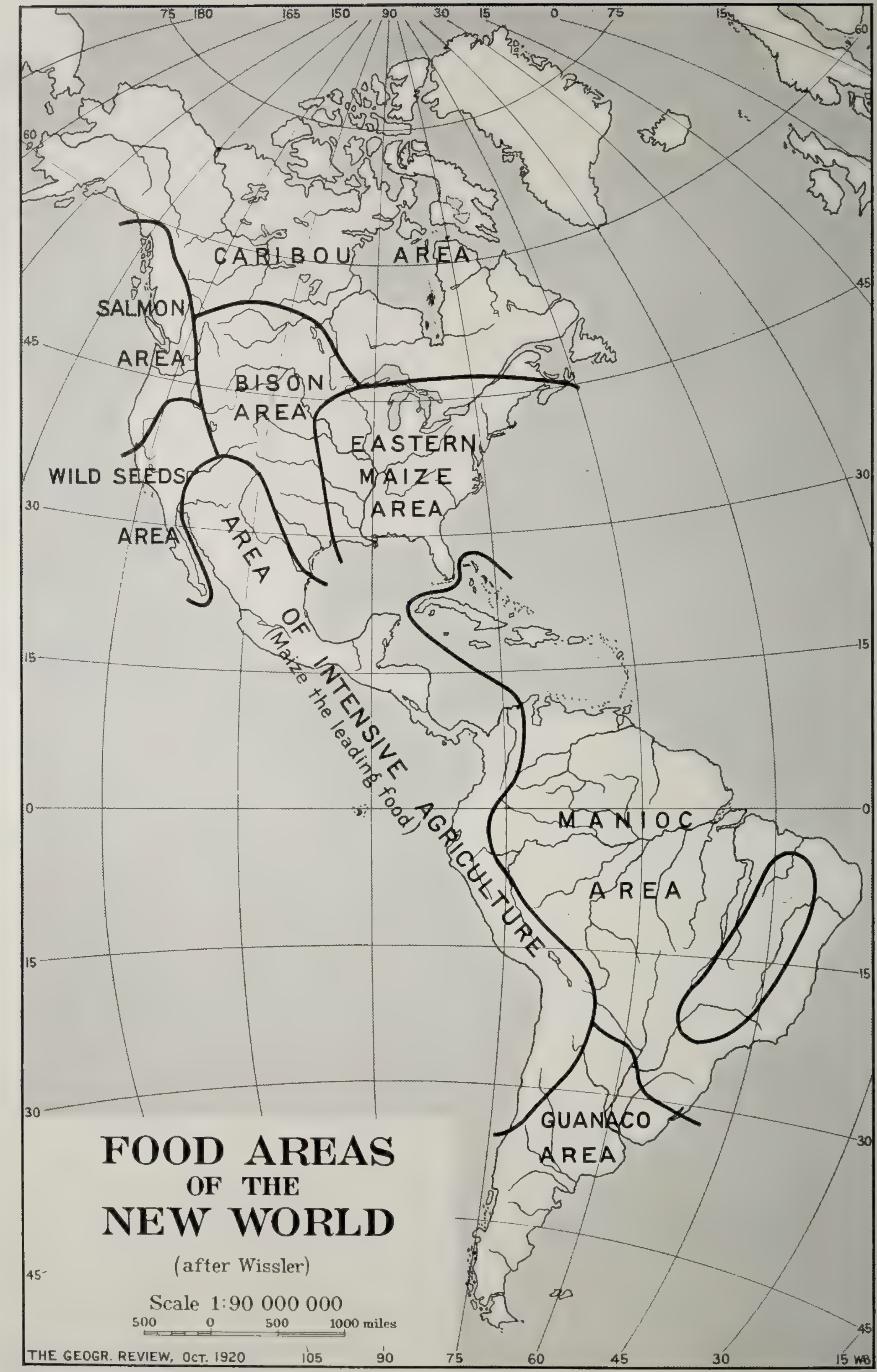

FIG. 1—Map showing distribution of the staple food resources of the aboriginal peoples of the New World (drawn with slight modification from Fig. 1, p. 8 of Wissler's "The American Indian"). The eight areas may be grouped thus: three are the homes of hunting peoples; three of agriculturists; one of fishers; one of gatherers of wild seeds. In regard to the caribou area it should be noted that though the seal plays so large a part in Eskimo economy, the caribou is also an indispensable resource.

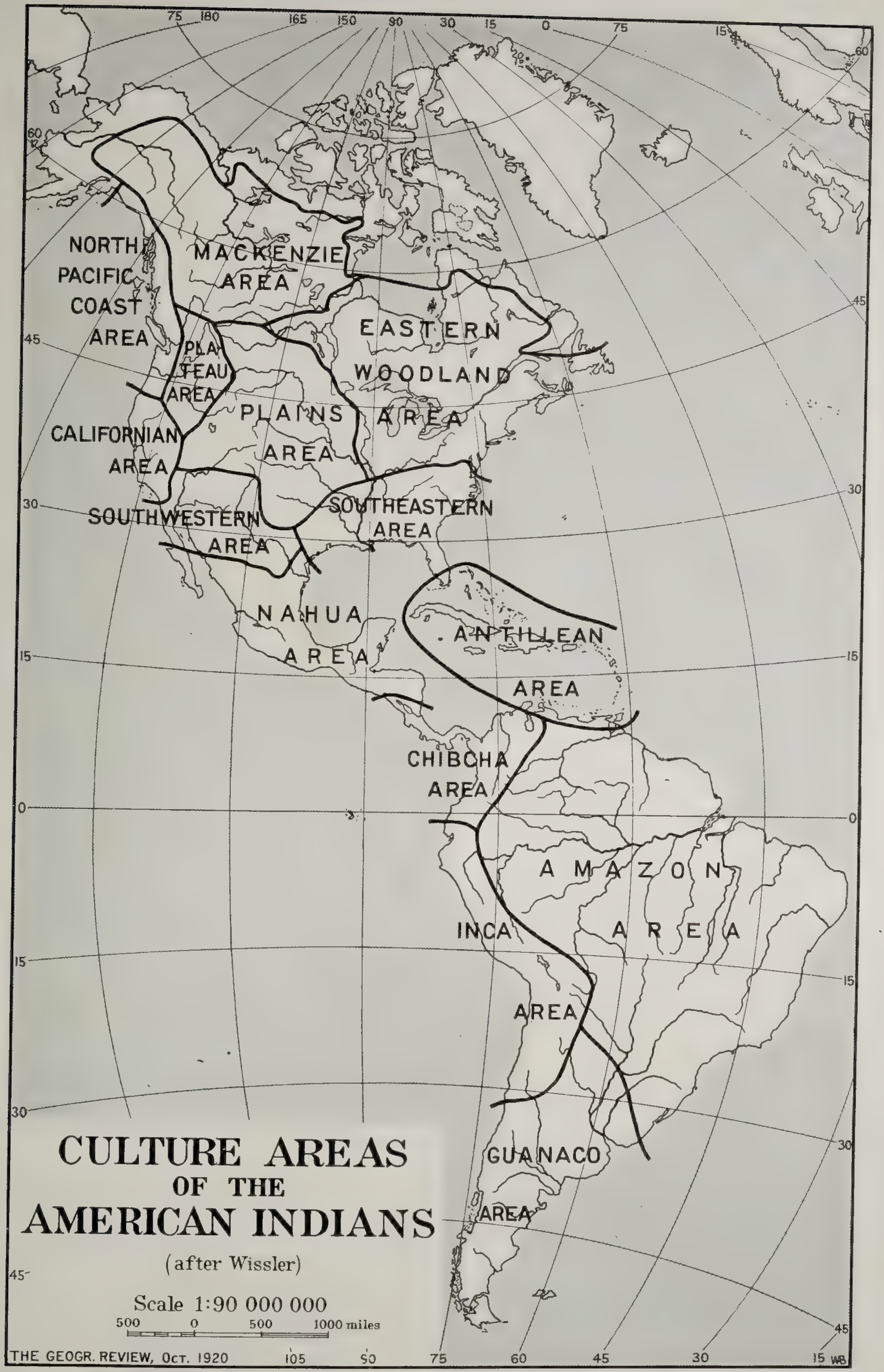

Fig. 2—Map showing the culture areas of the American Indians. The areas are defined by the typical groups at their centers: the boundaries are relative only, for the areas merge at their edges. In his map (The American Indian, Fig. 67, p. 205) Wissler's boundaries are geometrical lines. They have here been modified in accordance with data contained in the text and with the boundaries as shown in Wissler's earlier map, the Culture Areas in North America, North American Indians of the Plains, Handbook series No. 1, American Museum of Natural History, 1912.

conceptions of property and political rights are similar. New World culture may be depicted as "a kind of pyramid whose base is as broad as the two Americas and whose apex rests over Middle America."

With this essential unity in mind we may pass to the problem of New World origins. The somatic characteristics of New World man proclaim his affinity with the Mongoloid peoples of Asia. The problem resolves itself into the question of the date of his arrival in the New World and the equipment he brought with him. Wissler's conclusion is that we must postulate an early date for the arrival and a state of culture little advanced; we must, in fact, concede Interglacial man in America. The traits brought over from the Old World were of man's early heritage, the fire drill, stone chipping and polishing, perhaps domestication of the dog, and so forth. The more advanced of the fundamental traits of New World culture are, on the contrary, distinguished by their originality.

The high centers of the New World must then be conceived of as parallel to, not derived from the high centers developed by the Mongoloids of the Old World. In the New World the fundamentals of Maya culture can, as we have already stated, be found among the less advanced people. There are similar evidences that Chinese culture sprang from original Mongoloid groups settling in the valley of the Yellow River. The Chinese center received stimuli from other non-Mongoloid cultures: the Maya center was cut off from such favorable influences. The geographical situation of these two complex and independently developed cultures calls for the assumption of a northern cradle from whence the two migratory groups would set forth. Study of New World origins takes us back from Mexico and Peru into the heart of Asia.

GEOGRAPHICAL RECORD

NORTH AMERICA

Physiography and Life Zones of Panama. The reports of the Intercontinental Railway Commission and the studies of the Isthmian Canal Commission have given us at least the outlines of the physiography of Panama. But in an important paper by Edward A. Goldman (Mammals of Panama, *Smithsonian Misc. Colls.*, Vol. 69, No. 5, 1920) we have our knowledge of the physiography applied in the biological field in a manner of special value to geography in that the text is illustrated by a life zones map which is here reproduced. The author conducted a biological survey of Panama, visiting among other places the Chagres region, Porto Bello, and eastern Panama. He points out that large areas, including important mountain ranges, remain unexplored. One of the parts least known is the area controlled by the San Blas Indians from which other native tribes and foreigners have been consistently excluded (see S. P. Verner: The San Blas Indians of Panama, in the July number of the *Geographical Review*).

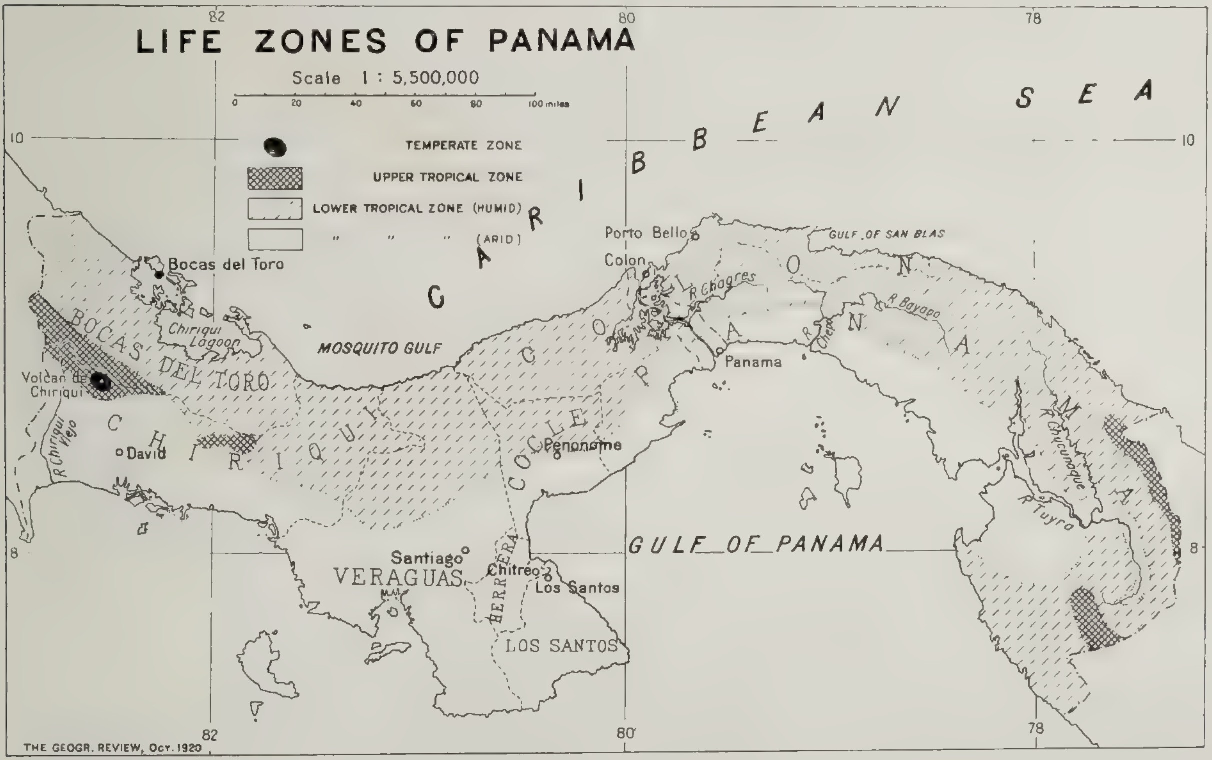

FIG. 1—Map showing the provisional life zones of Panama (after that accompanying the paper cited in the text).

After treating the physiography of the Isthmus of Panama the author passes to the climatic conditions and their faunal relations. So far as the natural life is concerned the study has a peculiar timeliness because the republic of Panama is still sparsely populated, clearings are few, and the natural life as yet relatively undisturbed. The region is especially interesting from the standpoint of biogeography because it is a meeting ground of forms from South America and North America. In Tertiary times oceanic waters probably extended across the isthmus in a number of places—certainly across the Canal Zone, which forms a distinct faunal boundary. For the region as a whole the fauna is so diversified and as yet so little known that any classification into life zones must be regarded as tentative in character. Three provisional life zones may be recognized. Their characteristics are summarized below:

1. *Lower Tropical Zone.* An area of high temperatures, including by far the greater part of the isthmian land surface. It extends from sea level to 3,000 or 3,500 feet along the higher mountains. Here live most of the animals and plants of the region. The zone is divided into a humid northern and eastern and an arid southern division. The humid division is characterized by a persistent evergreen forest, and the arid division by deciduous foliage and by the interruption of the forest zone by open grassy savanas which become parched in appearance in the dry season.

2. *Upper Tropical or Subtropical Zone.* This zone embraces the crests and slopes of mountains from 3,000 to 8,000 feet in altitude. Almost the entire area is densely forested with palms, and the zone as a whole is humid but with marked differences of precipitation due to varying slope exposure.

3. *Temperate Zone.* This zone extends from 8,000 feet upward, with varying temperatures near the summit. The Volcan de Chiriqui, with summit elevation of 11,500 feet above sea level, is the only place in Panama where the zone is developed. The trees are smaller in size with short trunks and widely spreading branches. The zone seems to have the characteristics of higher zones in the mountains of Costa Rica. It contains representatives of the boreal life zones of North America.

Notes on the Climate of Panama. Were it not for the heavy rainfall of the Canal Zone the great canal locks could not be operated through the four-month dry season. But sometimes there is too much rain water. What would one of our towns look like if in the course of a 7.60-inch rainfall in 24 hours, about 2.50 inches fell in 3 minutes? This seems to have been the experience of Porto Bello, on the Atlantic Coast of Panama, on November 29, 1911. From the automatic record of this cloud-burst it appears that 3.22 inches fell from 12:45 to 1:50 A. M., 0.13 inch from 1:50 to 2:07, 2.47 inches from 2:07 to 2:10, and 0.49 inch from 2:10 to 2:45. Although a rainfall of 2.47 inches in 3 minutes exceeds by 100 per cent the rate of fall during the rain of July 7, 1889, when 8.07 inches fell in 20 minutes at Curtea de Arges, Rumania, heretofore considered the world's record, it seems best to accept this as an actual occurrence (H. G. Cornthwaite: Panama Rainfall, *Monthly Weather Rev.*, May, 1919, pp. 298-302; B. C. Kadel: The Most Intense Rainfall on Record, *ibid.*, May, 1920, pp. 274–276).

The rainfall at Porto Bello in November and December together averages 48 inches, an amount greater than the annual fall over three-quarters of the United States; and, in addition to this, Porto Bello is washed by 10 feet more of rain during the remainder of the year. More than half—most of the Atlantic watershed—of the Canal Zone has an average annual rainfall exceeding 100 inches. Is it any wonder that there are land slides, that a dense tropical jungle flourishes there, that swamps are extensive, and that mosquitoes and the yellow fever and malaria they transmit led to the failure of early canal attempts?

Now that the malignant indirect effects of the excessive rainfall are under control, how can man get along with the tropical heat, the enervating humidity, and the deadening equability? The answer is: daytime cloudiness, a sunlight-absorbing blanket of moist air, and a breeze. The average daytime cloudiness in the dry season, December to March, is about 50 per cent, and in the rainy season, April to November, about 75 per cent. In the dry season the interior and the Pacific side have more cloudiness than the Atlantic side, where the wind comes off the sea clear. In the rainy season the nights are cloudy, while in the dry season the daytime cumulus clouds disappear in the evening. Although Panama is in one of the cloudy belts of the earth, there is, on the average, only one day a month that the sun does not shine; and the longest consecutive period without sunshine of which there is authentic record, was 4 days (H. G. Cornthwaite: Sunshine and Cloudiness in the Canal Zone, *Monthly Weather Rev.* May, 1920, pp. 276–277; Humidity and Hot Weather, *ibid.*, pp. 277–278). Fortunate for man is it, that every day the earth puts up its convectional cloud sunshade.

But this is protection, not relief. A steamy summer's day in the United States shows us occasionally what the weather feels like in Panama during the rainy season. The computed average maximum sensible temperature for July (wet bulb) is 79° F. at Balboa Heights (Pacific side) and 78.5° F. at Cristobal (Atlantic side). The average maximum air temperatures, however, are 87° and 84°, respectively—like St. Louis and Philadelphia in July. A wet-bulb temperature three degrees lower than in the rainy season, and twice as much wind, make the weather of the dry season less oppressive. In spite of the humidity there have been but two deaths from sunstroke and but 21 cases of heat exhaustion in a population of 120,000 in 13 years! The eastern United States has no such record; but perhaps if we worked with no greater intensity than do the people of Panama, our heat-stroke record would be better.

We face a perplexing situation: hot, arid regions with brilliant sunshine—no sunstrokes; a hot, extremely humid region—few sunstrokes; moderately humid, warm regions —occasional sunstrokes; and, finally, we remember that most tropical lowlands with climates apparently like that of Panama are dangerous for the white man who does manual labor or exposes his head to the sun. In Liberia the coastal lowlands have temperature, humidity, cloudiness, and rainfall characteristics much like those of the Atlantic coast of Panama, but a white man can get a "touch of the sun" with only a few minutes exposure, and manual labor, such as is performed constantly by white men in Panama, is here deadly (see Emory Ross: The Climate of Liberia, *Geogr. Rev.*, Vol. 9, 1919, pp. 387–402). Evidently the sunlight is more intense there, and probably also in moderately humid warm regions, than in Panama. Either intense sunlight or high wet-bulb temperatures are livable for the white man, but not the two in combination. From the white man's point of view no description of a tropical climate can be complete without information as to the intensity of sunlight.

Charles F. Brooks

EUROPE

A New Ethnographic Map of Rumania. A first-class contribution to human geography has been made by Professor Emmanuel de Martonne in an article on the ethnography of Rumania (Essai de carte ethnographique des pays roumains, *Annales de Géographie*, March 15, 1920, pp. 81–98). It is the result of extended field work in Rumania, principally in the northern and central Carpathians, and of an examination of all of the available sources of data. His conclusions are particularly important at this time because of their relation to the new boundaries of Rumania as established on the west by the Hungarian treaty and on the south by the Bulgarian treaty. On her eastern frontier Rumania still occupies Bessarabia, but her title to the region has not been confirmed by the Great Powers, who are waiting for the Russian situation to clear up before expressing an opinion as to the merits of Rumania's claims in this direction.

One of the most striking of the author's conclusions is that the boundary on the west is perhaps the most difficult of all because of the intimate mixture of Rumanians and Magyars, as well as other nationalities, precisely in the border zone where a boundary line must be placed. The matter is further complicated by the location of the principal towns, such as Temesvar, Arad, Nagy Varad, and Szatmar-Nemeti, which lie right in the narrow transition zone, and for which there was naturally waged a violent contest, the more so since the towns are connected by a railroad that is the chief line of communication for a large region.

De Martonne finds that the Rumanians are most nearly homogeneous in the regions of former Roman colonization, that is, in western Wallachia, the eastern Banat, and western Transylvania. They are most mixed in those portions of the country long included in neighboring states of different nationality, either during many centuries as in Transylvania or during the course of the last century only as in Bukovina and Bessarabia. The purest Rumanian populations are found in the Carpathian valleys.

Rumanians appear for a long time to have preferred the forested regions of considerable relief, rich in water and pasturage. Movement to the plains and the absorption of foreign elements that existed there were later developments. In pushing outward the population has not stopped at natural boundaries, and this invites comment by the author to the effect that a map constructed on a geographical principle would show relations between the history and the physical geography that are hidden in maps constructed on a purely statistical principle.

The special value of de Martonne's map lies not alone in the care exercised in its construction but also in his choice of three shades of density which permit one to see at a glance not only the nationality involved at a given point but its relative density, which means, in general, its relative importance. The larger cities are represented by divided circles that show the nationality percentages.

AFRICA

The Development of the Coastal Belt of South Africa. On the eastern and southern coasts of South Africa there is a belt averaging 100 miles wide, varying in elevation from sea level to 6,000 feet, with a great variety of climate and of vegetable products. Fruits of almost every sort grow prolifically. Stock raising is carried on, farm products of wide variety can be produced. In any study of the possibilities of future white settlement in South Africa this coastal belt has unusual importance, since it is capable of much greater agricultural development in contrast to the high but relatively temporary development about Kimberley (diamonds) and Johannesburg (gold). There has now been published a paper of considerable interest to geographers in that the economic geography of the region is set forth systematically (T. Caink: The Possibilities and Development of the Coastal Belt of South Africa, *South African Journ. of Sci.*, Vol. 16, 1919, pp. 211–225).

The author has made a detailed study of the rainfall distributions and the run-off; and he finds that an important part of the coastal belt enjoys a rainfall above 40 inches, and some of it as high as 70 inches. Detailed tables are given. The belt of more intense rainfall is from 10 to 30 or 40 miles wide and roughly 1,000 miles in length. To be conservative the author takes an average width of 15 miles, giving a total catchment area for the belt of 15,000 square miles. From a study of the general resources of the region he would propose, not white settlement in the region of heavier rainfall, but the absence of settlement and the development of a forest cover. He would then introduce the principles of irrigation, storing the water for the dry season and encouraging particularly the practice of building small irrigation works for tributary supplies. To carry out the plan he advocates the purchase of the rain belt by the government, the development of a forest cover, the equalization of run-off, the building of railways, and the development of water power. With an abundance of cheap labor and a favorable combination of sunshine and water supply, he would turn the region into one of intensive agriculture and industrial development. The oil, nuts, rubber, cocoa, and cotton that now go by steamer to Europe he would bring from tropical Africa to South African ports to be manufactured, in the coastal belt, for export. He arrives at the conclusion that the whole coastal belt of 85,000 square miles could eventually become a great industrial center like England with a population of 50,000,000, or 600 to the square mile.

AUSTRALASIA AND OCEANIA

The Tapestry Forests of Hawaii. Associated with the more humid aspects of the highly dissected Hawaiian topography is a peculiar form of the rain forest to which Vaughan MacCaughey gives the name "tapestry forest" (Hawaii's Tapestry Forests, *Botanical Gazette*, August, 1920, pp. 137–147).

The tapestry forest is developed on the precipitous slopes that to the eye appear almost vertical. Actually the range of these slopes is between 40° and 80°, averaging 50° – 60°. In altitude this forest ranges between 800 and 4,500 feet. It presents a primitive appearance, steepness, wetness, and general inaccessibility having prevented the devastations wrought by man and animals on the lower slopes. The struggle against wind and gravity leaves a marked impress on the trees. They are dwarfed and gnarled and distinguished by a remarkable system of anchoring and bracing roots. Where erosion has removed the scant soil cover the roots are exposed as a sort of natural ladder utilized by natives and woodsmen in climbing slopes that otherwise would not infrequently prove impossibly steep. There is an abundant shrubby undergrowth. At the lower elevations lianas form almost impenetrable jungles. Above 2,000 feet, where fog and mist prevail throughout the greater part of the year, lianas give place to damp soggy moss formations. The foliage in general tends to small, glossy leaves which with the general similarity in the shape of the tree crown contributes towards uniformity in appearance. Individual trees are distinguished by differences in the green tints. Looked at from below this heightens the effect of drapery expressed in the appropriate term tapestry forest.

WORLD AND LARGER PARTS

Who Owns the Earth? Under this title J. E. Spurr analyzes the mineral wealth of the world and the relative positions of the United States, England, and Japan (*Engineering and Mining Journ.*, Vol. 109, 1920, pp. 388–391). The chief value of the paper lies not in its political discussions but in its two accompanying diagrams showing, the one, the comparative commercial (financial) control and the other, the territorial (political) control of eighteen minerals by principal producing countries. Some of the most important conclusions are as follows. The United States produced, in 1917, 71 per cent of the world's petroleum. It leads in the production of iron and steel, copper and lead, sulphur, phosphate rock, vanadium, aluminum, and several other mineral products. The British Empire leads in tin—a key industry—and in nickel, gold, graphite, and tungsten; it is fast gaining on the United States in petroleum production and is second to us in coal. Russia formerly (1913) led in manganese production, but the effect of present conditions is to give Britain the lead. Territorially Spain is foremost as a producer of mercury but financially the industry is dominated by Britain. Of the few minerals remaining outside the control of the United States and the British Empire, the chief are the nitrates of Chile and the potash reserves now divided almost equally between France and Germany. The paper contains opinions by the author as to the effect of these distributions upon the political policies of the leading industrial nations.

GEOGRAPHICAL REVIEWS

Syria and the Syrian Question

Augustin Bernard. **La Syrie et les Syriens.** *Ann. de Géogr.*, No. 151, Vol. 28, 1919, pp. 33–51.

Arthur Ruppin. **Syria: An Economic Survey.** Transl. and abridged by Nellie Straus. 92 and iv pp.; bibliogr. The Provisional Zionist Committee, New York, 1918. 75 cents. 9 x 6 inches.

The author of "La Syrie et les Syriens" first calls attention to the historic frontiers of the country, which included the region from Antioch to the Sinai peninsula and from the Mediterranean to the desert east of the coastal mountains. Thus defined Syria is a strip of country 600 miles long and less than 100 miles wide, in which the sea plays somewhat the same rôle as the Nile in Egypt. He would not accept the old boundary of the Orontes at the north, considering the Taurus and the Anti-Taurus as the natural frontier on this side—the more as the Gulf of Alexandretta is a coastal feature of vital importance, a natural outlet for large parts of Syria, Mesopotamia, Armenia, and Anatolia; and if held by any one of these with no outside supervision, the result would be harmful to the other interested parties.

The author reviews the agricultural possibilities, particularly the production of cotton on the plains of Adana where 800,000 hectares of cotton land may be eventually developed. The railroads reflect the vagaries of international politics. They are local lines that now need integration. Only their connection with those of Anatolia, Mesopotamia, and Egypt will bring Syria into one of the main currents of world trade. In Phoenician times Syria was a great center of the Near Eastern world; and this position it kept until the Turk came and the route to India was opened. The opening of the Suez route was a final blow to the commercial power of Syria. Far-famed Damascus kept only its commerce with the desert Bedouins.

The former population of Syria is alleged to have been 20,000,000 to 30,000,000; its present population is estimated at 3,500,000 to 4,000,000, or 26 to the square mile. More than a quarter of the population lives in the 28 principal cities. The rural population is very unevenly distributed. The greatest regional density is 230 to the square mile, in the Lebanon. The security of the plains, as well as their greater fertility, is responsible for the concentration of population there. The limits of nomadism, like the isohyets, run in a southwest-northeast direction. A half million Syrians live outside Syria—in the United States, Mexico, Argentina, Brazil, Australia, western Africa, and Japan. Immigration is almost negligible, and the increase of population is slow, owing to massacres, a high rate of infant mortality, and bad government. A few Berbers have come in, a few Kurds, a few German colonists, and the Zionist colonists of Palestine.

There is a useful discussion of the mixture of races and religions. There are 29 officially recognized religious groups, which fall into three main classes—Mohammedans, Christians, Jews. Of the total population nearly 2,500,000 are Mohammedans. There are 950,000 Christians, or one-fourth of the total. Of these the largest group is composed of 380,000 Maronites; then come the Greek Orthodox with 240,000. Jews numbered only 30,000 seventy years ago and now number 100,000 in Palestine or 125,000 in all Syria, including Palestine. The author argues against Jewish control in a Zionist state. He considers the religious question less formidable than many others, seeing that religious differences were formerly made the instrument of politics and that left alone, Armenians and Kurds, Maronites and Druses live together peaceably. Effective policing would reduce the raids of the nomads. Even so its mixture of races and religions will make Syria difficult to govern. It is believed that in time there will be three foci of population: a Mohammedan focus at Aleppo and Hama; a central Christian focus at Beirut; a southern Jewish center at Haifa and Jerusalem. There would also be a nucleus of Mohammedans at Damascus, of Druses in the

Haurân, and of Armenians about the Gulf of Alexandretta. Left to rule themselves, there would be bloodshed; an outside force is necessary. French commercial and political interests and objects are reviewed briefly.

From the list of references given and from internal evidence, Ruppin's survey of the economic condition of Syria seems to be the result of careful work. It is really a source book of the commercial geography and economics of Syria. Its trade statistics are logically arranged. The resources of every kind are described in illuminating terms whether the author deals with forestry, or agriculture, or irrigation. Of special interest is a list (pp. 29–31) of the Jewish agricultural settlements of Palestine in 1914, giving location, area, population, principal products and date of foundation. The accompanying notes on these colonies give a close view of their history and present economic status.

Historical Claims and Territorial Disputes in Central Europe

E. Schwab. **Territoriale Abrundungsbestrebungen in Mitteleuropa: Ein Beitrag zur historisch-politischen Geographie der ehemaligen österr.-ung. Monarchie.** Map. *Kartogr. und Schulgeogr. Zeitschr.*, Vol. 8, 1919, Nos. 5 and 6, pp. 76–79. Vienna.

The greater part of this paper deals with the historical successions and territorial changes that have taken place in the six geographical systems, so-called, that lie in the Danube basin. Each system is now expressed politically in a national home (owing to the break-up of the Austro-Hungarian realm), and each has in the course of history brought forth an empire of wide influence and extent. The fullest extent of each, at some time in its history, has been reached at the expense of its neighbors. Thus have arisen conflicting historical claims that have led to present-day territorial disputes of grave consequence for the peace of Europe. By combining the historical with the ethnic principle the author has derived a map, printed in color, which shows the overlapping claims of Central Europe and part of the Balkans. Nothing else could show more clearly at once the great complexity of the territorial disputes of the region and the custom of European peoples of thinking historically in contrast to the simpler processes related to boundary settlements that operate in America and other relatively new lands.

An Ethno-geographical Analysis of Indian Cultures in the Gran Chaco

Erland Nordenskiöld. **An Ethno-Geographical Analysis of the Material Culture of Two Indian Tribes in the Gran Chaco.** xi and 295 pp; maps, diagrs., ills., bibliogr. (Comparative Ethnographical Studies, Vol. 1.) Göteborg, 1918. 9½ x 6½ inches.

Idem. **The Changes in the Material Culture of Two Indian Tribes under the Influence of New Surroundings.** xvi and 245 pp.; maps, diagrs., ills., bibliogr. (Comparative Ethnographical Studies, Vol. 2.) Göteborg, 1920. 9½ x 6½ inches.

In these two volumes Dr. Nordenskiöld gives the results of his studies of Indian tribes of southern Bolivia and northern Argentina initiated years ago and continued in several later expeditions. Dr. Nordenskiöld's method is to assemble the information supplied by the literature; to supplement this with information on the civilization of the Indians from missionaries and travelers; and, in the light of the data thus acquired and of his own field studies, to analyze the material culture of the Indians. The two volumes together contain 60 maps, showing the distribution of culture elements among the Choroti, Ashluslay, Chiriguano, and Chané. These Indian tribes occupy the region from Santa Cruz de la Sierra southward nearly to the Rio Bermejo—the transition country between the Andean realm and the plains of Gran Chaco, a region in part densely forested, in part poorly wooded. The location of the settlements is governed by the water supply. While some of the streams are through-flowing the greater number of them disappear at the inner edge of the piedmont plain. Big game is scarce. The Chiriguano and Chané Indians live almost wholly by agriculture; maize can be produced easily. In years of little or no rain the crops are a failure. The Choroti and Ashluslay are restricted to the neighborhood of streams or deep wells in the dry season. The wet season is from December to April or May. On account of the contrast in the Choroti and Ashluslay country between the wet and the dry season and the abundance of wild fruit agriculture is very little developed. Fortunately the trees of the region are of a variety which furnish an exceptional quantity of food.

The first volume deals with the distribution of elements of material culture—pipes, carrying nets, wooden spoons, earthen ovens, drums, etc., among the Choroti and Ashluslay. In the concluding chapters the author sets forth in exhaustive tables a list of cultural elements borrowed by these Indians from: (*a*) the whites since the discovery; (*b*) the culture of high mountain and plateau country to the west; (*c*) the culture of northern South America. After eliminating these elements he finds that a considerable number of cultural elements of unknown origin remain over and represent a remote period. Some are restricted to the Gran Chaco, and these appear to have close connections with the cultural elements of the Patagonian Indians.

From the maps in the second volume showing the distribution of dwellings, platform beds, hammocks, trumpets, panpipes, masks, etc., Dr. Nordenskiöld concludes that the Chiriguano and Chané tribes came from the north and have very close cultural associations with the tribes of the Amazon realm. He thinks that it was in order to facilitate intercourse with the culture of the mountain zone (that is the culture of the Bronze Age) that the Chané wandered southward along the Andes to the more open country of the Gran Chaco where communication was easier, though he does not overlook the possibility that they may have been forced southward by other tribes. The Chiriguano established themselves in their present localities about the beginning of the sixteenth century and quickly picked up the Bronze Age culture from the original inhabitants of the Gran Chaco, whom they conquered. They adopted the culture of the original inhabitants, but the original inhabitants adopted the language of the conquerors. The Chiriguano and Chané thus borrowed heavily from tribes having cultural elements of a more advanced character but borrowed scarcely at all from tribes like the Tobas and Matacos of more primitive culture. A few of their cultural elements have come in from northern and eastern South America. One such is the india-rubber ball game; others are the hammock and the seat, possibly known to them before they migrated to the Gran Chaco. An interesting feature is the fact that they have kept from the time of their migration to the Gran Chaco some things that are of minor importance in their present habitat, for example, fishing tackle.

The author departs from Wissler's classification of the food areas of South America (see map, Fig. 1, p. 264). Wissler recognizes three: (1) area of intensive agriculture, (2) manioc area, (3) guanaco area. The proposed division of Nordenskiöld is: (1) area of intensive agriculture, (2) area of manioc and fishing, (3) area of wild seeds and fishing—El Gran Chaco, (4) guanaco area.

Both volumes close with a very extensive bibliography, and the second volume also includes six bibliographical maps of an extremely useful kind. From them one can pick out for a given region the chief bibliographical sources. The dates of five of the maps are as follows: 1498–1600, 1600–1700, 1700–1800, 1800–1900, 1900–1920. The sixth map displays the archeological literature.

THE FRENCH-INDIAN MÉTIS IN THE DEVELOPMENT OF THE UNITED STATES

L. S. HOUGHTON. **Our Debt to the Red Man: The French-Indians in the Development of the United States.** With an Introduction by Francis E. Leupp. xi and 210 pp.; ills. The Stratford Co., Boston, 1918. 8 x 5½ inches.

The purpose of this little book is to prove that the "Indian has done more for us than we realize, or at this distance of time shall perhaps ever be able wholly to ascertain." It is not geographical except as it bears on the question of the part played by environment versus heredity. Its general method is very simple. Some of the good traits of the aboriginal Indians and their successors are pointed out; then follows a discussion of the Indian half-breeds with many references to individuals and to their achievements. The result is not, perhaps, as imposing as the author believes, but it shows that many persons with Indian blood have done excellent work and have been good citizens while a few have distinguished themselves.

In spite of this, the book is one of the strongest indictments of the Indian ever written. It repeatedly emphasizes the fact that the individual achievements of the race have been the work, not of pure Indians, but of French *métis* or mixed bloods. This is in accord with the laws of eugenics, provided it be true that the average Indian is mentally less alert than the average white man. Crosses of the Indians with the English, as the author points out, have usually resulted in poor, shiftless offspring; crosses with the Scotch and Irish have been somewhat better, while those with the French have produced many able people. The explanation is not the incompatibility of the Indians and the English, as the author assumes, but simply a result of social conditions. Marriage with the Indians was regarded with high disfavor by the English, and such unions as came about were usually between Englishmen of low character and Indian women of a lower grade. Among the Scotch and Irish, marriages with the Indians were not so much frowned upon while by the French they were regarded with favor. Consequently many Frenchmen with the best sort of inheritance married daughters of Indian chiefs. Naturally the descendants of high-grade ancestors on both sides have proved competent and useful, while the descendants of low-grade Englishmen and low-grade Indian women have proved incompetent.

Ellsworth Huntington

Alberta and British Columbia: Interprovincial Boundary Report

Report of the Commission Appointed to Delimit the Boundary Between the Provinces of Alberta and British Columbia: Part I, from 1913 to 1916. 2 vols.: text and atlas. Text: xi and 191 and [5] pp.; diagrs., ills., index. 10 x 7 inches. Atlas: 27 maps. 18 x 15½ inches. Office of the Surveyor General, Dept. of the Interior, Ottawa, 1917.

This report of the Interprovincial Boundary Commission describes the method of survey and especially the technique of photographic survey employed, the monumentation of the boundary, and the present condition of roads and trails within the scope of the accompanying maps. There is now needed an integration of the cartographic data with data already available from similar work by the Canadian forest service and the geological survey.

Future explorers and students will find the Commission's comments on trails particularly useful. It appears that "any trail, the existence of which has at any time been authenticated by surveyors, packers, prospectors, or other travelers and which has once been marked on the maps of a district, is reproduced on each succeeding issue of such map without further knowledge of the present-day condition of such trail." The present state of the trail is of course a more important matter than the mere location of it. Fallen timber and later growth may have completely blocked a given trail since it was opened. The matter is a special feature here because the coming of the railways and the resulting diversion of freight routes has led to the opening of new roads and trails and the abandonment of many of the old ones.

The report is illustrated by many clear and useful photographs; and it is accompanied by an atlas of twenty-seven maps—twenty-six detailed maps, sixteen on a scale of 1:62,500, eight on a scale of 1:25,000, two on a scale of 1:35,000, and a general assembly sheet on a scale of 1:792,000. All of the maps represent a very high grade of technical skill in drafting and printing.

A NEW CLOUD ATLAS

LUIGI TAFFARA. **Le nubi. Part I; Testo;** 67 pp.; diagrs., ills. **Part II, Atlante** [26 pls.] R. Ufficio Centrale di Meteorol. e Geodinamica, Rome, 1917. 14 x 9½ inches.

That meteorology was far from dead in Italy during the war was clearly demonstrated by the activities of the forecasting service in connection with the military operations of the Italian armies, a matter which was several times referred to in this *Review*. Another indication of the excellent work which has been going on in Italy along meteorological lines is the publication of a new cloud atlas, prepared by Luigi Taffara. The appearance of such a work is sure to attract attention at any time, because of the widespread popular interest in clouds and in their significance as weather prognostics. This interest is, however, especially keen at present, when the development of war flying, and of commercial flying since the war, has directed attention to the study of the free air and especially to the mapping of the upper air currents. The forms and movements of clouds are clearly of the greatest value in determining the directions and velocities of the air currents above the earth's surface which are such critical factors in flight.

In "Le Nubi" the history of cloud classification, and the work of the International Meteorological Committee in connection with cloud classification and observation, are first considered. Then follows a somewhat detailed, and very practical, discussion of cloud photography, in which plates, screens, filters, methods of developing and printing, times of exposure, etc., are considered. Four photographs illustrate the effects of intensifying the original plates. The system of cloud nomenclature suggested by the author, while in its fundamentals following that recommended by the International Cloud Committee, is a far more elaborate one, embodying to a large extent the modifications suggested by Vincent in his "Atlas des nuages" (1907) but including also certain sub-types recommended by others, such, e. g., as the *cirrus filosus* and *cumulus pendulus* of Clayton; *cumulus simplex* and *cumulus compositus* of Weilbach; *cirrus uncinus* of Maze, and other special varieties of the principal forms. Of low clouds there are 25 types; of the intermediate there are 12, 11 of these being varieties of alto-cumulus; and of the upper clouds there are 19. That individual observers who are cloud specialists do need very detailed cloud classifications is obvious; but it is no less clear, as experience has abundantly proved, that for the general run of meteorological observers the world over, a simple and easily learned system of nomenclature, like that adopted by the International Meteorological Committee, is alone practicable. While in no way urging the limitation of the work of such specialists to the simple International scheme, it is the opinion of the present reviewer that nothing more elaborate than the standard international nomenclature is desirable, or possible, for general use. A discussion of methods of observing clouds occupies 30 pages of the text. Nephoscopes of various well-known types are described. An account is given of Marangoni's perspective nephoscope, by means of which the observer, taking observations of two points of the same cloud sheet, can determine the vertical component of cloud motion as well as the horizontal. A method of using a theodolite for making similar observations is described, and, at the end, the theodolite photogram nephoscope of Taffara is illustrated and described.

The "Atlas" includes 26 plates, each plate having two illustrations. Some of these are in colors, two being reproductions of water-color sketches, and one a reproduction of a pastel. The majority of the original photographs were taken by the author and are here seen for the first time. They illustrate every cloud form included by Taffara in his new system of nomenclature. Doubtless most of those who have the opportunity of examining this valuable Atlas will agree in picking out, as unique and most striking pictures, the five photographs of *cumulus simplex* which illustrate the special cloud type designated the *Cortessa del Vento* (Pls. 11, 12, 13). This is a peculiar form of cumulus, in the shape of a helicoidal spiral, which is described (text, p. 15) as often developing to the east of the central crater of Mt. Etna.

R. DE C. WARD

THE
GEOGRAPHICAL REVIEW

VOL. X | NOVEMBER, 1920 | NO. 5

THE PORT OF PARIS

By ALBERT DEMANGEON
The Sorbonne, Paris

The Seine has been associated with the life and fortunes of Paris during the entire recorded history of the city. The river not only served as a defensive barrier to the new and growing town, surrounding the island on which it was situated, but early fostered in its inhabitants an instinct for traffic and commerce by water.

Long before the Roman period a stream of commerce poured through the valley of the Seine, coming up from the Mediterranean through the Rhone Valley and ending on the shores of Great Britain, where, as everyone knows, the ancient world obtained the greater part of its tin. During the first century of our era there existed in Paris a wealthy corporation of boatmen, the *Nautae Parisiaci*, who occupied themselves exclusively with shipping on the Seine. With the decline of the Roman Empire the Seine lost its prestige as an international trade route and as such disappeared from Continental history for several hundred years. Nevertheless, as Paris grew in importance the river contributed materially to its development. The Seine was of such consequence to the city that as early as the twelfth century the "water merchants" formed one of the richest corporations of Paris with special privileges granted them by the kings of France. By the middle of the fourteenth century this corporation was at the head of the municipal administration; its arms and motto, "Fluctuat nec mergitur," had been adopted by the city, and the corporation's chief had become the chief civil official of the municipality.

For hundreds of years it was the Seine that fed Paris. Food supplies and construction materials came by water. In the seventeenth and eighteenth centuries, after the building of the great royal roads, the rôle the river played diminished somewhat in importance, but it remained preponderant nevertheless, and the most animated marts of trade and barter were always those on the water front. At the beginning of the nineteenth century the railroads began to make serious inroads on the traffic, many foodstuffs came by rail, the markets were moved from the Seine to quarters nearer the centers of the city and more accessible to the consumers.

In spite of these changes the Seine traffic continued to be an important factor in the city's economic development. Paris, steadily enlarging, outgrew its walls, overran its suburbs, invaded lands once on its very outskirts, and became one of the great urban agglomerations of the world. The growth of the port of Paris corresponds with the growth of the city; it is now the port for a region of 4,000,000 inhabitants; its traffic (15,228,085 metric tons) surpassed in 1913 that of Marseilles (8,938,652 metric tons), the greatest maritime port of France.[1] These figures are based on the traffic within the confines of the Department of the Seine alone. If one considers that Greater Paris really includes many districts at some distance from, but still under the influence of and in direct contact with, the metropolis—in other words it extends upstream as far as Corbeil (31 kilometers) and downstream as far as Bezons (32 kilometers)—the sum of the volume of traffic rises to the enormous total of 27,000,000 tons.

Subdivisicns of the Port of Paris

Most well-informed people are aware of the importance of the port of Paris, but many of them would be at a loss if asked to define its exact boundaries. Paris has no distinct harbor district as other ports have, rather there are many harbors in many districts scattered along the course of the river and its canals. The river traffic is not concentrated; there is no one dominant group of docks, wharves, warehouses, etc.; on the contrary the traffic is widely dispersed along the shores. It is essential, therefore, to consider what may be called the geographical subdivisions of the port of Paris; and for a clear understanding of these one must bear in mind that the port began with the city and developed continuously with it.

There are three distinct sections or districts which have gradually become merged into one system as the city has grown and expanded. These three districts are: (1) the Seine within the city limits, (2) the Seine in the suburbs, (3) the canals of the city.

THE SEINE WITHIN THE CITY

The intramural course of the Seine is 12.3 kilometers long, and a considerable portion of both banks is used for the loading and unloading of freight cargoes. There are fewer wharves and slips in the center of the city, and they are small and narrow. Through the quarters of Notre Dame, the Palais de Justice, the Louvre, and the Tuileries, the river flows tranquilly between stone quays surrounded and topped by tall buildings and monuments. But upstream and downstream such structures no longer crowd to the water's edge; there is more room for factories, for trade, and consequently for the river traffic. So it happens that commerce on the waterway tends to the outlying quarters, particularly to those upstream. More than 14 kilometers of the banks have been devoted to wharfage. On the right bank are the quays of Bercy, La Râpée, Henri IV, Célestins, Hôtel de Ville, Louvre et St. Nicolas, Tuileries et Concorde, Champs Elysées, Conférence, Debilly, Passy, and Auteuil. On the left are Tolbiac, Gare, Austerlitz, St. Bernard, Tournelle, Montebello, Orfèvres, Saints-Pères, Solferino et Orsay, Invalides, Gros-Caillou, La Bourdonnais, Suffren, Grenelle, and Javel. It is a constant source of amazement to those who go to see the Seine at Paris to find that at almost every group of piers building materials are being unloaded—sand, gravel, stone, and brick. This is because the city, constantly growing, spreading out, changing, has to have a landing place in every separate quarter for the heavy building materials that are constantly required. In addition to this, however, each group of wharves belonging to each quarter of the city specializes in some particular article of commerce. Bercy handles wine; La Râpée coal, wood, and paper pulp; Louvre et St. Nicolas is given over to merchandise brought from England by small coasting vessels; La Gare to casks and petrol; Austerlitz receives a varied assortment of goods in its stores and warehouses—precious woods, boxes, castings, marbles, machinery, grains, preserves, sugar, and wheat; St. Bernard, like Bercy, handles wine; Javel, coal and refuse. These intramural docks ranged in a series along the city's banks disposed in 1913 of more than one-half of the entire amount of merchandise loaded and unloaded in the entire system of Paris ports that year, more than 6,700,000 tons.

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[1] In 1918 the traffic of the port of Paris reached a volume of 12,784,343 metric tons.

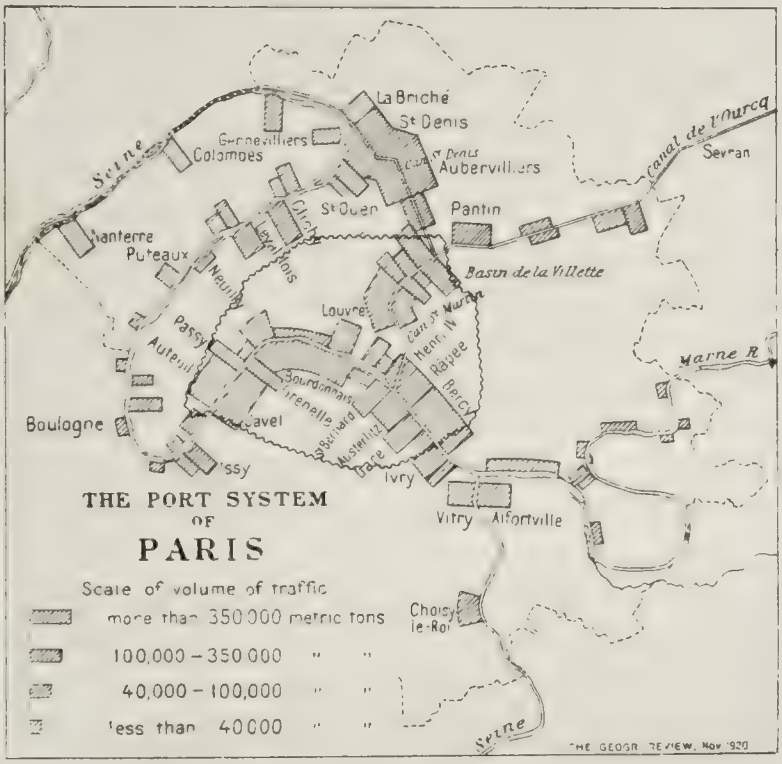

FIG. 1—Sketch map representing the volume of water-borne traffic at the subdivisions of the port of Paris in the Department of the Seine. Paris has no special harbor district: traffic is dispersed along the banks of the Seine both within the city and in the suburbs and along the tributary canals. Scale of map approximately 1:3,900,000.

THE CANALS OF PARIS

During the eighteenth century Paris grew towards the northeast, beyond the *faubourgs* of St. Denis, of St. Martin, and of the Temple. Groups of houses sprang up in the direction of La Villette, between the heights of Montmartre and Belleville. These newer parts of the city lay away from the water front. To keep them in communication with the river it was decided to build an artificial waterway, and a canal system was laid out comprising the St. Denis Canal (6,750 meters in length), which was completed in 1821, and the St. Martin Canal (3,200 meters in length), completed in 1825. A third canal, that of the Ourcq, planned primarily to furnish water to the other two, was opened in 1826 and made into a navigable channel. Thus a complete circuit was established, from the lower Seine at La Briche near St. Denis, to the upper Seine in Paris at the Arsenal basin, connecting with the waters of the Ourcq Canal at the Villette basin. The system comprising these three canals is called the Municipal Port, because it belongs to the City of Paris. These canals go through the busy industrial sections, among the factories and workshops. The beautiful views along the Seine find no rivals here; here are no monuments and gardens, no delightful walks shaded by ancient trees; here are only prosaic and utilitarian objects, sheds and warehouses, mills, cranes, coal yards, wood yards, piles of stones and of sacking. The Villette basin at the junction of the canals carries a traffic of more than 1,000,000 tons. Districts of wharves and piers succeed each other along these waters; on the Ourcq Canal lie Pantin, Bobigny, Noisy-le-Sec, Bondy, Pavillons; on the St. Martin Canal Pantin, Combat, Récollets, Marais, Arsenal; on the St. Denis Canal Flandre, Aubervilliers, Stains, St. Denis. In 1913 these waters carried over 3,000,000 tons of freight, principally coal destined for the use of the mills and factories in these quarters and in regions contiguous to them.

The Seine in the Suburbs

As the Parisian population spread out far beyond the city's walls the port of Paris extended itself also, above and below the town. Many factories driven from the city proper by the increasing value of the land, moved into the suburbs, as close as might be to the Seine where they could receive their raw materials and coal by water. Thus the third distinct division of the port developed: upstream, St. Maurice, Joinville, Choisy-le-Roi, Alfortville, Vitry, Ivry; below, Billancourt, Boulogne, Issy, Sèvres, St. Cloud, Suresnes, Puteaux, Neuilly, Courbevoie, Levallois, Clichy, Asnières, St. Ouen, St. Denis, La Briche, Gennevilliers, Colombes, Nanterre. These landings, which are principally used for industrial supplies, have a volume of traffic of some 3,000,000 tons.

Projected Improvements

Plans are being made for further extensions of the port. It is probable that in the near future the Parisian waterways system will have added to it a great canal from the Marne, designs for which have been almost completed by the engineers in charge. The scheme is an attempt to avoid the troubles incident to the Seine floods.

The canal is to start from the Marne, near Annet north of Lagny, is to pass Claye, Sevran, Aulnay-sous-Bois, and to enter the Seine at St. Denis after a course of 34 kilometers. It will have a flow of 500 cubic meters a second from the waters of the Marne and will thus lower the flood level of the waters in Paris by 1.5 meters for a great inundation such as that of 1910. It will not only lower the high-water levels of the great floods but will entirely do away with the effects of the smaller freshets which disturb navigation yearly. And above all it will open up to the north of Paris a direct route by which vessels may avoid the tortuous and difficult journey through the city and which will enable the Lorraine ores and the coal from the Sarre region to be shipped directly to the port of Gennevilliers below Paris. This port is another projected improvement which will add greatly to the volume of river traffic. It is to be excavated in the alluvial deposits of the Seine westward of Paris, and is to be brought into relation with the network of railways comprising the Western and Northern railway systems. There are to be two basins, one for trade and commerce, the other for the factories which will be built there. It will be the great downstream harbor, the port for the maritime traffic that will come up the Seine when its channels are deepened. Seagoing and inland-waterway vessels will transship cargoes there, as they now do at Rouen, and there will be in addition a great volume of freight from eastern France, coming down by river boats to be transferred there to ocean-going ships.

To sum up, the port of Paris is divided into three distinct parts: (1) the river within the city itself, carrying about half the traffic; (2) the river in its course through the suburbs, carrying about a quarter of the traffic; (3) the canals, which carry about a quarter of the traffic. The port extends along the Seine for some 53 kilometers, from Choisy-le-Roi to Nanterre, and for 14 kilometers more through the canals of the town, 67 kilometers of waterways in all, on which were carried, in 1913, 15, 288,085 tons of freight.

The Seine As a Waterway

The characteristics of the Seine as a waterway are clearly reflected in the long history of navigation on the river from the earliest days to the remarkable development of an inland merchant marine during our own era. Of all the rivers of France the Seine is the one whose system of waters is best adapted for constant use as a means of communication. The topography of the Seine valley is such that it lends itself better than any other valley in France to connection with other basins and to the extension of its waterways. Of all the regions of France the district about Paris is the one where man has most employed his art and skill in altering and improving navigable streams.

THE CHARACTER OF THE SEINE

The Seine is notable among French rivers for its tranquil, steady flow. While other rivers pour down from mountain heights, the Seine, rising at an altitude of only 470 meters, runs into a shallow basin of but slight inclination. At Paris, 180 kilometers from the sea, the Seine is but 25 meters above sea level, the grade to the ocean thus being only 7 centimeters per kilometer; whereas on the Loire between Ponts-de-Cé and Nantes the grade is 16 centimeters per kilometer and on the Rhone between Lyons and the sea, 45 centimeters. Consequently the waters of the Seine flow quietly, without turbulence; and even in times of flood they rise slowly, not suddenly. The rainfall too is distributed with comparative regularity throughout the seasons of the year. Paris does not suffer from seasons of drought as do the Mediterranean shores and, on the other hand, has few torrential downpours to score the earth and flood the streams. Three-quarters of all the land in the Seine basin—59,210 out of 78,650 square kilometers—is permeable soil, hence the greater part of the rainfall filters through and feeds the springs which in turn keep the rivers supplied with water during the summer season. The Seine has less reason than the Loire to fear summer drought.

The Seine deposits little alluvium, there are no sand bars or gravel banks impeding the course of the stream as there are along the Loire, and its channel is a fixed one, not varying with every freshet. Thus, given a slight incline, a regular flow throughout the year, and a clear channel, the Seine was naturally from earliest times a superlatively safe and useful watercourse, an invaluable artery of commerce and intercourse for the entire region. This very fact makes the more serious the exceptional accidents—floods, drought, or frost—that from time to time interfere with navigation. In more recent years engineers have devised various means for controlling the waters. Dams have been erected between Paris and Rouen, the level of the low water has been raised, there is no longer danger from a possible drought. But attempts to regulate the high water from upstream have not been so successful, though it is hoped that the floods too will soon be under control.

Connection With Other Basins

The commercial value of the Seine is greatly enhanced by the fact that it can so readily be connected with streams in neighboring basins. The bordering elevations are slight, it is easy to cross to the Loire, to the country around the Meuse, the Moselle, the Rhine, and the Scheldt. A complicated system of communications has gradually developed, radiating from Paris. It was France that built the first canals in all Europe to cross divides, connecting basin with basin. The earliest ones were planned to secure provisions for the city. The first canal system joined the Seine and the Loire; the Briare Canal was opened in 1642, the Orléans Canal in 1692, the Loing Canal in 1721. Thus as early as the seventeenth century Paris was in direct communication with the districts about the Loire, rich in grain and wine. But it was not until 1822 that the canal that paralleled the upper Loire and was to bring Paris coal from St. Étienne was begun, and this was not completed until 1856.

A second system of canals united Paris and the northern country. The St. Quentin Canal, 1724–1810; the canal paralleling the Oise, 1831; the canal from the Sambre to the Oise, 1839; the Ardennes Canal, 1835. Of all these engineering developments the finest and most useful was the St. Quentin Canal, between the Somme and the Scheldt, which was designed to connect the coal fields around Valenciennes with Paris. In constructing this canal it was found necessary to drive two tunnels through chalk, one 5,670 meters long at Riqueval, one 1,098 meters long at Tronquoy. For a number of years and as late as 1831 the greatest difficulty was experienced in making the bed of the canal water-tight, for the waters drained out constantly through the permeable rock. But when the work was finally

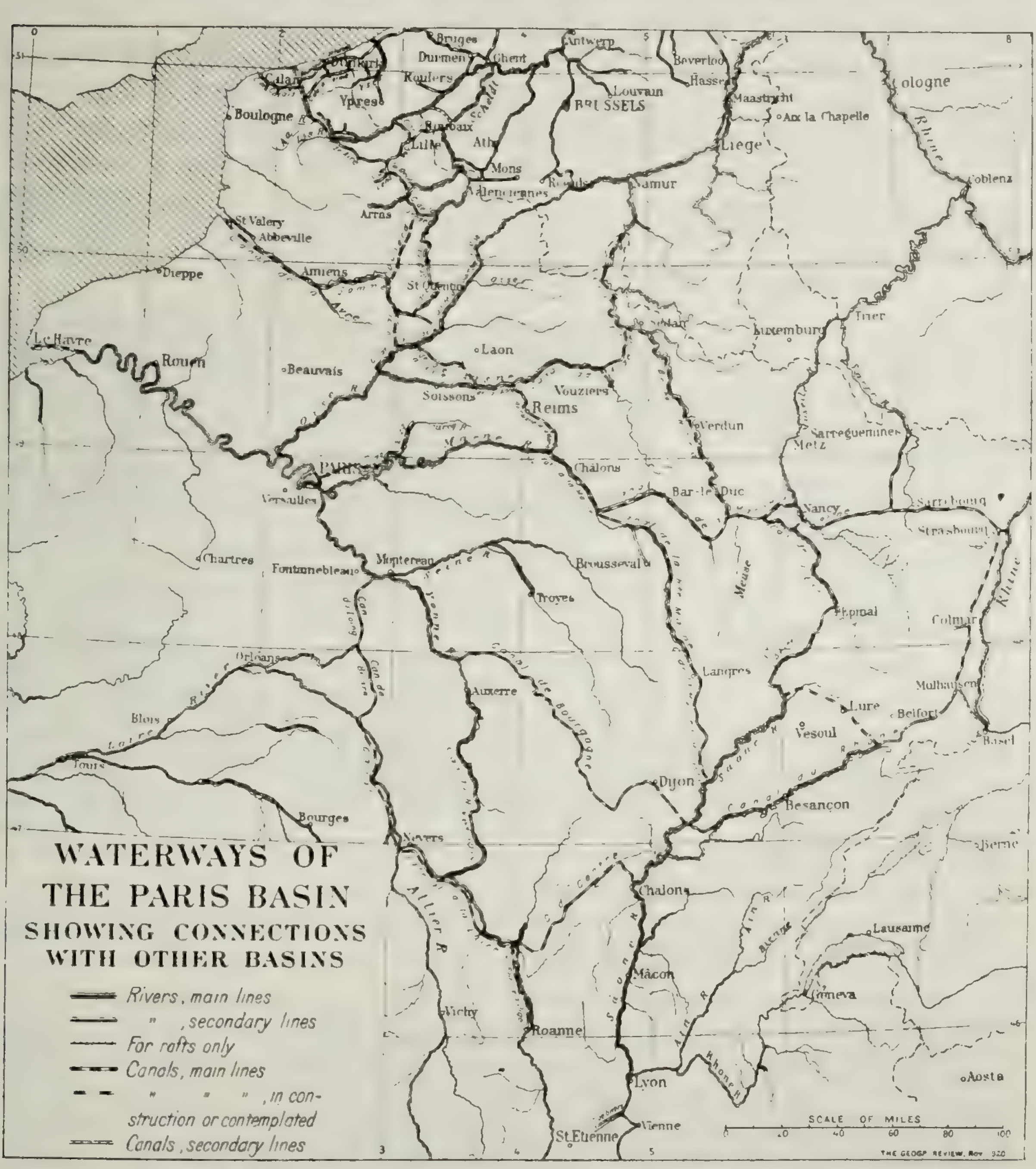

FIG. 2—Map showing the waterways of the Paris Basin and its connection with adjoining basins. Scale 1:5,000,000.

completed it was a fine stretch of waterway, admirable for its time, through which enormous quantities of coal could be brought down to Paris and all its industrial outskirts. These shipments of fuel have now grown so great that the St. Quentin Canal is shortly to be duplicated by the Northern Canal now in the course of construction.

A third system of canals connected the Seine with the country to the eastward—the Bourgogne Canal (1832), between the Yonne and the Saône, and the Rhine-Marne Canal (1853). By means of these Paris was able to draw upon districts at a greater distance for its provisions of wine, wood, and building materials.

Improvement and Standardization of the Waterways

The capacities of the waterways that carry the shipping of Paris have been greatly increased by extensive engineering work on the rivers and canals. Everywhere natural conditions have given way to the needs of commerce, and man's efforts in this direction, accomplished at the expense of much labor, are not yet completed.

The adoption of the standard gage gave the railways their greatest advantage. A car could travel over the lines of any company from one end of the country to the other. The canals and rivers of France on the contrary were handicapped by the diversity of their dimensions. Built at different periods, according to the necessities of the time and the place, and with resulting variations in depth, locks, and general construction, the canals were totally inadequate to meet the needs of a growing volume of traffic stimulated by the rapid expansion of urban and industrial life. In 1879 the Freycinet laws were passed requiring certain uniform dimensions along navigable waterways—depth 2 meters; width of locks 5.2 meters; inside length of locks 38.5 meters; clearance under bridges 3.7 meters. These laws adapted French waters to the measure of the Flemish pinnaces of 300 tons' burden that brought coal to the Villette basin in Paris. These dimensions were adhered to in remodeling the principal canal systems, the St. Quentin and the Sambre-to-Oise Canals which connect Paris and the North; the Marne-Rhine Canal and the river Marne connecting eastward with Alsace and Lorraine; the upper Seine and the Bourgogne Canal connecting Paris to the southeast with Lyons; the Briare and the Loing Canals connecting with the districts to the southward which in turn are served by the Loire and the Central Canal. Paris was thus put in direct communication with the coal mines, with the industrial centers, and with the forest regions of France which lie beyond the Seine basin.

Connection With the Sea

But it was still necessary to connect Paris with the sea and to give her access to that universal highway. The Seine reaches the English Channel by Rouen and Havre, but this natural route did not meet modern needs.

The channel of the Seine varied greatly, deeps alternating with shallows impassable in times of low water. At the beginning of the nineteenth century it was quite usual to harness up from thirty to forty horses to drag the ships through the worst places (Bezons, Poses, Martot). In earlier days these inconveniences were tolerated, but they became unendurable when the necessity for a rapid and regular traffic began to develop. Toward the middle of the nineteenth century it was decided to build dams and locks in the shallow places so as to raise their levels. From 1832 to 1866 there were built seven locks between Paris and Rouen (Suresnes, Bezons, Andrésy, Meulan, La Garenne, Poses, Martot) giving eight reaches where vessels could be sure of an anchorage depth of 1.6 meters. These first improvements were soon outgrown and a second series begun. From 1879 to 1888 under the operation of the Freycinet laws two more locks were added, and the anchorage depth of the Seine waters was increased to 3.2 meters from Port-à-l'Anglais (4 kilometers above Paris) to Rouen, 250 kilometers in all.. Lighters of 1,000 tons' burden could then pass up and down the Seine. To permit this traffic direct entry into Paris the waters of the St. Denis Canal and the Villette basin were also given a minimum depth of 3.2 meters. These improvements gave an astonishing impetus to traffic on the lower Seine; from 1881 to 1911 shipping on the river from Rouen to the confluence of the Oise increased from 933,600 tons to 3,777,600 tons. The time has now come, however, when further changes are imperative and

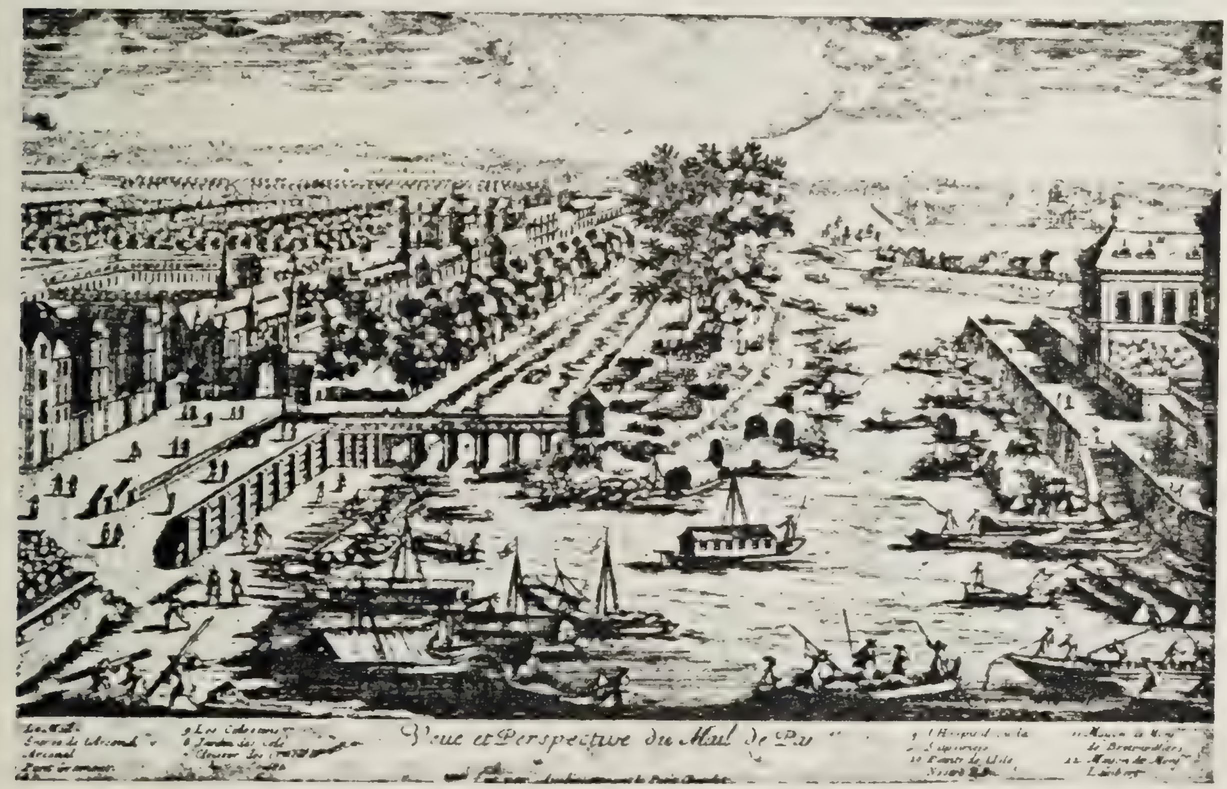
Veue et Perspective du Mail de Pa
Arcenal

FIG. 3—The Seine at the beginning of the seventeenth century. View from an old engraving. Looking up stream: on the right Ile St. Louis; on the left the buildings of the Arsenal. The island in the center where cargoes of wood are being discharged is now attached to the mainland and is occupied by the quai Henri IV.

the establishment of direct relations between Paris and her oversea trade is necessary. This need has given rise to the various plans known to the public at large by the general title of the seaport-of-Paris projects.

Up to the present time the best known of these projects has been that of the engineer Bouquet de la Grye (1880). His scheme was to dredge the Seine to a depth of 6.2 meters, to have six reaches between Rouen and Paris, to build cut-offs across some parts of the winding stream, to straighten some of its curves, and to raise the bridges. This plan was abandoned as being too expensive. The floods of 1910, however, called the public's attention again to the work along the Seine, and with the idea of preventing future disastrous inundations in Paris and its environs the Commission proposed that the Seine channel should be deepened to 4.5 meters between Paris and Bougival. Immediately the question why this improvement should be limited to the neighborhood of Paris was raised. Why indeed not continue the excavation of the channel as far as Rouen? Paris has championed this idea in the face of hesitation and doubt on the part of the Ministry. The city realizes that river barges of 2,500 tons, seagoing barges, and even coasting vessels could come directly up the river, that all this traffic could be accommodated in the artificial harbor of Gennevilliers just below Paris, and that thus Paris would be brought into her desired contact with ocean navigation.

Port Facilities

Deepening the channel will not be the only problem. The banks of the river must be provided with suitable facilities for the reception and expedition of cargoes. These installations will require considerable planning. It is not as if this were a new land where every project could be put through without any other considerations. As in all old countries the past hampers men, and the city is not free to develop its port at will.

The great advantage of the port of Paris is that its ramifications extend throughout the very heart of the city and that it offers an unusual amount of wharfage for the accommodation of vessels. In its course through the city the Seine becomes in reality an artificial waterway entirely controlled by man. Islands have been connected with the shores, the banks raised and straightened, the bed of the stream narrowed. From one end of the city to the other the river flows between walls of masonry from which quays are built out, narrow in the center of the town, larger in the outlying quarters given over to manufacturing and trade. In early days the shores were almost all sloping, so that rafts and the little craft of those days could be dragged up the banks; these landings were called tow landings. Modern vessels cannot lie against such a sloping bank, and during the last twenty-five years landings that rise perpendicularly from the water level have been gradually substituted for the tow landings. Today merchandise is loaded and unloaded on twenty-nine modern wharves, about 10,756 meters long in all, with decks varying from ten to seventy meters, and on nine tow landings, 3,690 meters long in all. To these must be added the landing stages, some 5,917 meters long, used only for the unloading of lumber and firewood.

NEED OF MODERN INSTALLATIONS

It is obvious that the port of Paris does not lack wharfage room along the shores of its rambling river, but the commercial use of these waters is interfered with by the fact that there are thirty-three bridges, some of them very low and consequently very dangerous, on account of which navigation ceases at night. Then, too, there are all manner of floating bathhouses and washhouses encumbering the stream and hampering the movements of vessels. Above all there is not enough room between the wharves and the town for the necessary shops, warehouses, railways, and equipment. Very few great storage buildings are seen along the shores of Paris. The warehouses at the Villette basin, at Ivry, at the Arsenal basin, and at Austerlitz are the exceptions. The fact that there are so many points along the whole water front easily accessible for barges has apparently retarded the adoption of mechanical means of unloading. One may still see this work carried on in many places by hand, men unloading sand with shovels, carrying coal ashore in sacks on their backs, or lugging bags of cement. These scenes appear picturesque to the strolling onlooker but are ridiculous in the extreme from the point of view of modern commerce. There are only a few private landings on the Seine where suitable equipment has been installed, at Gennevilliers for the Suburban Gas Company, at Issy for the Electric Service Company, at Ivry for the Light and Power Company, and at Austerlitz. In the public landings used for general traffic the equipment is wretched, there are few cranes, and labor by hand is slow and costly. Another dis-

FIG. 4—Fête on the Seine about 1640 (after a print by Callot). Looking down stream: on the right the Old Louvre; on the left the famous Tour de Nesle.

advantage is that there is little direct connection between the wharves and the railway lines. These latter cannot be brought down to the water front because of the already enormous congestion of urban surface travel, street cars, omnibuses, carriages, automobiles, and pedestrians. On most of the docks along the Seine cargoes are discharged into horse-drawn drays or motor trucks. There are but few landings where the railroad runs to the river so that merchandise can be transferred directly from ship to car and vice versa. On the Eastern Railroad only Villeneuve-Triage above Paris and La Villette are in direct touch with the shipping; on the Paris-Lyons lines only Bercy, Charenton, and Villeneuve-St. George; on the Western Railroad there are Javel, St. Cloud, and Gennevilliers; on the Orléans railway the ports of St. Bernard, Ivry, and Austerlitz; on the Northern Railroad only St. Ouen. This is due, not alone to material difficulties, but to the systematic hostility of the railroads to any scheme for carrying freight by water.

The port of Paris also suffers from a malady common to all old countries, namely a conflict of authorities, growing out of the constant overlapping of administrative functions in the course of hundreds of years. Regulation of the port falls under three departments: the Department of Bridges and Highways, the Paris Municipality, and the Prefecture of Police. There is no single head, no co-ordination; there is consequently an infinite amount of neglect, indifference, and inadequate regulation. Every user of the public docks is free to bring materials there, to leave his barrows and carts, to pile up his merchandise, in a word to create as much confusion and disorder as he pleases. At Paris, as at London, Antwerp, and Mannheim, there should be a single authority which should have entire control of the use, upkeep, and general management of the port.

Such are the waterways of the port of Paris; let us now see to what uses they are put and what manner of commerce they carry.

The Traffic

Trade in the port of Paris, as the subdivision of the port within the very borders of the city indicates, is closely related to the economic necessities of the town. The port is not a center for foreign trade as are some other river ports of the world that are accessible to seagoing vessels, like Manáos in Brazil, Hankow in China, and Ghent in Belgium. It is not even a focal point for regional trade, the outlet for a large section of back country, as is Mannheim on the Rhine. It is essentially a port for the city of Paris alone; its activities are strictly local and urban. This limited rôle is oddly at variance with the position of Paris itself in the foreign trade of France.

The port, as a component part of the city, has grown with it. Since the beginning of the nineteenth century there has been a constant increase in the amount of incoming freight. In thousands of metric tons (tons of 1,000 kilograms), it was: 1,380 in 1823, 1,418 in 1830, 2,020 in 1840, 2,868 in

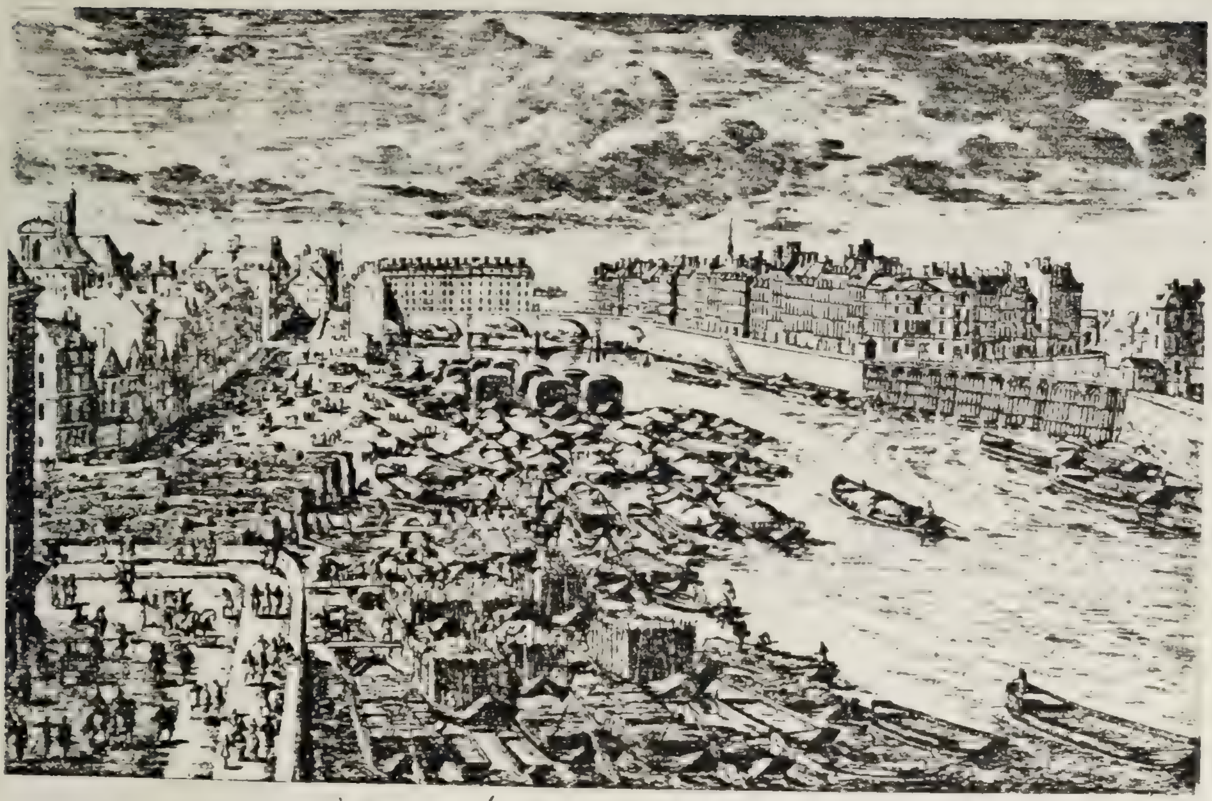
Le Quay de la greve, le Pont Marie & le Pont St Louis

FIG. 5

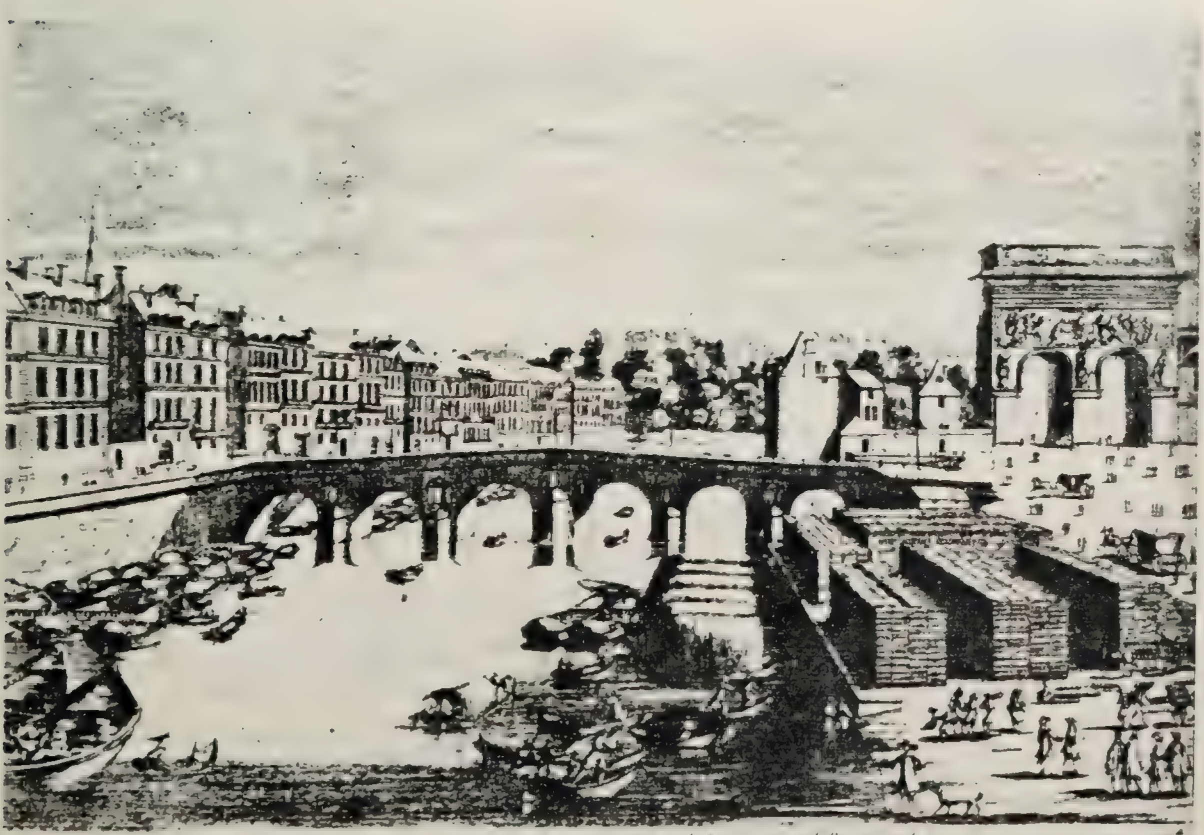

FIG. 6

FIG. 5—The Seine about 1670. View from an old engraving. Looking up stream: on the right Ile St. Louis; on the left the port of Grève, one of the most important ports of old Paris, now the site of the quai Hôtel de Ville.

FIG. 6—The Seine at the end of the seventeenth century. View from an old engraving. Looking up stream towards the pont de la Tournelle: on the right the double arch of St. Bernard, one of the gates of medieval Paris, now no longer standing.

1861, 3,675 in 1869, 4,469 in 1880, 7,567 in 1900, 8,205 in 1910, 11,709 in 1913.

When the improvements along the Seine, the tributary rivers, and the canals augmented the freight-carrying capacity of these waters they became dangerous rivals of the railroads. Whereas in 1860 67 per cent of the merchandise that entered Paris came by rail and only 33 per cent by water, in 1908 the proportion had become 53 per cent by rail to 47 per cent by water; and today the traffic is about evenly divided between the two, with a slight tendency in favor of shipping by water. The character of the Parisian trade and the special conditions surrounding it account for the fact that the gain in tonnage for the water routes has not been greater.

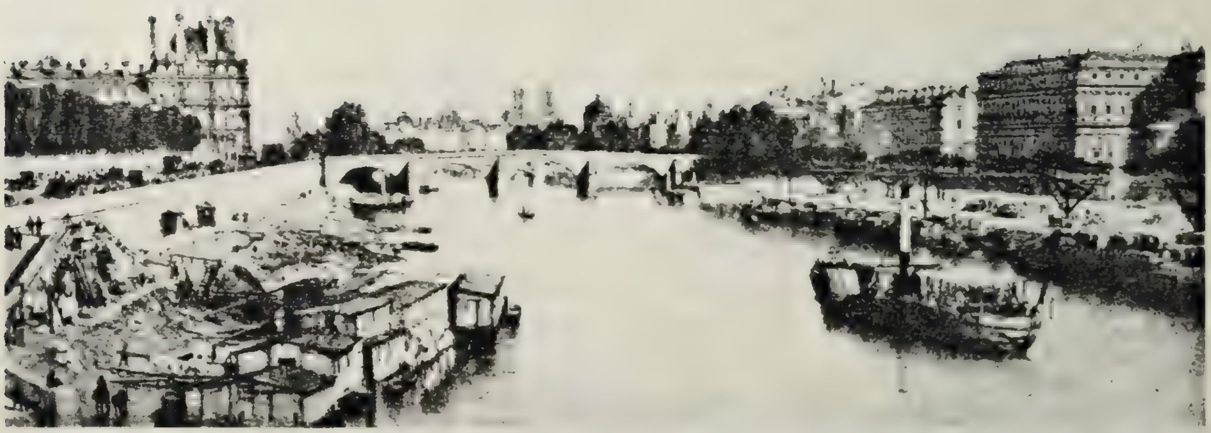

FIG. 7—The Seine in 1860 (from a photograph). Looking up stream: on the left the Tuileries (Pavillon de Flore); on the right wharves for the unloading of building stone.

CHARACTER OF THE TRAFFIC

The most curious single fact about the commerce of Paris is the disproportion between outgoing and incoming freight. Paris is not a great shipping port like Ruhrort on the Rhine or Duluth on Lake Superior but is essentially a port for incoming trade. The Seine brings to the city merchandise destined for consumption there; the situation is the same today as it has been in years past. In 1860 arrivals represented 76 per cent of all the traffic, in 1913, 73 per cent. But, although the greater part of the commerce of the port has always consisted of incoming shipments, the kind and nature of the shipments have completely changed in the course of the nineteenth century.

For hundreds of years the Seine, provisioning Paris, brought her principally foodstuffs: cereals and flour, salt, wine, fruit, vegetables, and eggs. Firewood was also brought from the forests of the upper basin by means of great rafts that made their way slowly down to the city. Fleets of small vessels gave the waters about Paris an air of extraordinary animation; many of these never left the port again, for the voyage back was long and expensive, and it was cheaper to demolish them. The banks of the river hummed with life; people from every section of Paris thronged to the market places by the waterside. As the nineteenth century advanced, and as the railroads developed, foodstuffs came no longer by water but by rail. The railroads were far better adapted to the transportation of light and perishable merchandise, the waterways more suited to shipments of heavy and bulky cargoes. The accompanying table (Table I) shows the incoming and outgoing freight for the year 1912.

Table I—Commerce of the Port of Paris, 1912

(The figures indicate the percentage of the total commerce)

PRODUCT	IMPORTS	EXPORTS
Coal	33.0	3.5
Building Materials	42.6	67.0
Fertilizers and Refuse	7.9	18.0
Agricultural Products and Foodstuffs	7.2	3.0
Manufactured Products	3.1	3.0
Metallurgical Products	2.3	4.4
Wood	2.7	1.0
Machinery	1.2	0.1

Of the imports foodstuffs hold but a minor place (7.2 per cent.) and consist of wines from Algeria, Spain, and Bordeaux via Rouen; grain and flour of both domestic and foreign origin; salted meats, sugar, salt, groceries from overseas. It is surprising to see fertilizing materials and refuse arriving in a city (7.9 per cent of the incoming tonnage); but this is explained by the fact that these cargoes are the street sweepings, garbage, etc., of the city that are being sent from one part of the town to another or to the disposal and reduction works in the suburbs at Issy, St. Ouen, Vitry, Stains, and Alfortville.

Coal and building materials form the bulk of the traffic, more than three-quarters of the entire amount received at the port. In a growing city like Paris the erection of new buildings and the construction of various public works necessitate enormous quantities of heavy materials, stone, sand, gravel, cement, lime, plaster. These are brought by the river and unloaded at the dockyards along its course. Coal is also an essential commodity to a city which is an industrial center, a consumer of light, heat, and power. Two-thirds of all the coal used in Paris is brought from England and northern France by way of the Seine. In fine, Paris receives few foods, few manufactured articles, and even few raw materials.

Comparison of the inward and outward shipments of Paris gives surprising results. Wreckage from the demolition of buildings, framing from construction work (classed as building materials), and refuse make up the greater part of the city's outward-bound shipments, 85 per cent of the whole. Thus the river can well be said, in view of the character of its chief cargoes, to be the means of cleaning, enlarging, and beautifying Paris.

Table II—Regional Distribution of the Commerce of the Port of Paris, 1912
(The figures indicate the percentage of the total commerce)

REGION	SHIPMENTS AT PARIS FOR:	ARRIVALS AT PARIS FROM:	TOTAL
Marne	1.4	6.8	4.1
Yonne, Saône, Rhone	2.0	1.5	1.75
Upper Seine, Loire, Allier	56.0	31.3	43.65
Lower Seine, Rouen, Havre	21.0	30.9	25.95
Oise, Northern Canals	6.0	23.3	14.65
Ourcq	13.6	6.2	9.9

As to the purely commercial traffic, the small amount handled should not surprise us. Paris is indeed a great industrial center, but its output does not consist of ponderous articles but rather of delicate things, objects of luxury, merchandise of great value but small volume, which would naturally be sent by rail. A few fast packets only carry down to Rouen and Havre articles from Paris bound overseas.

The port of Paris is therefore seen to be not so much a means of commercial relations with the outside world as an important factor in the life of the city, carrying its heavy domestic cargoes.

Direction of the Traffic: Origins and Destinations

Great changes have taken place in the direction of the traffic on the Seine in the course of the nineteenth century as well as in its character; in particular it shows a shift from the east to the north and the west.

As long as the Seine played so great a part in the provisioning of Paris the port's chief relations were with the upper basin. From up the river came grain and wood; from the Marne region came grain, flour, wine, iron, and wood; from the Yonne, wood, wine, bricks, and oil; from the Loing, coal; from the central region, fruits, wine, wood, metals, and tiles. From the lower Seine came some colonial shipments by way of Havre. The Oise region hardly counted at all.

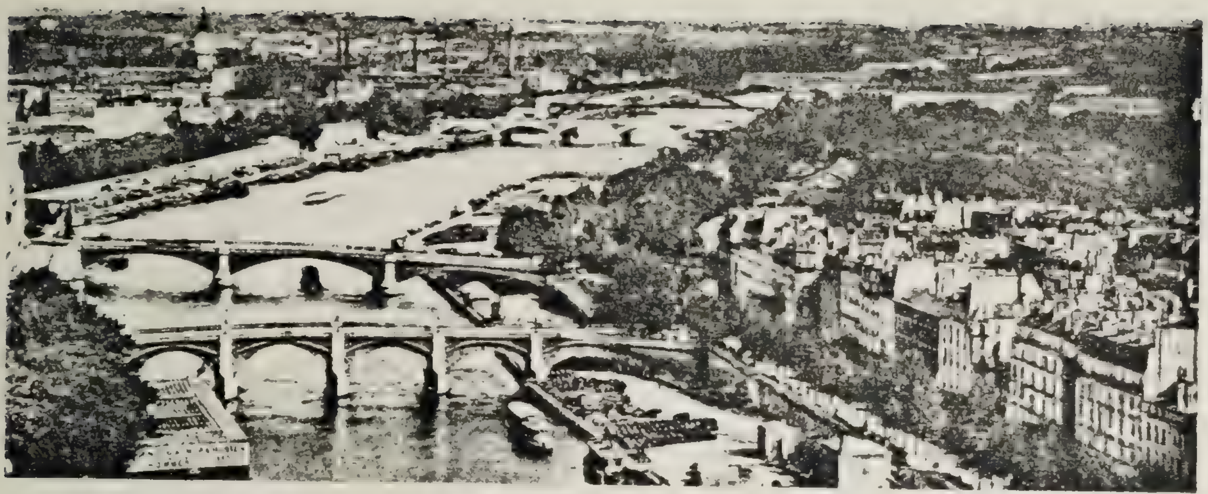

Fig. 8

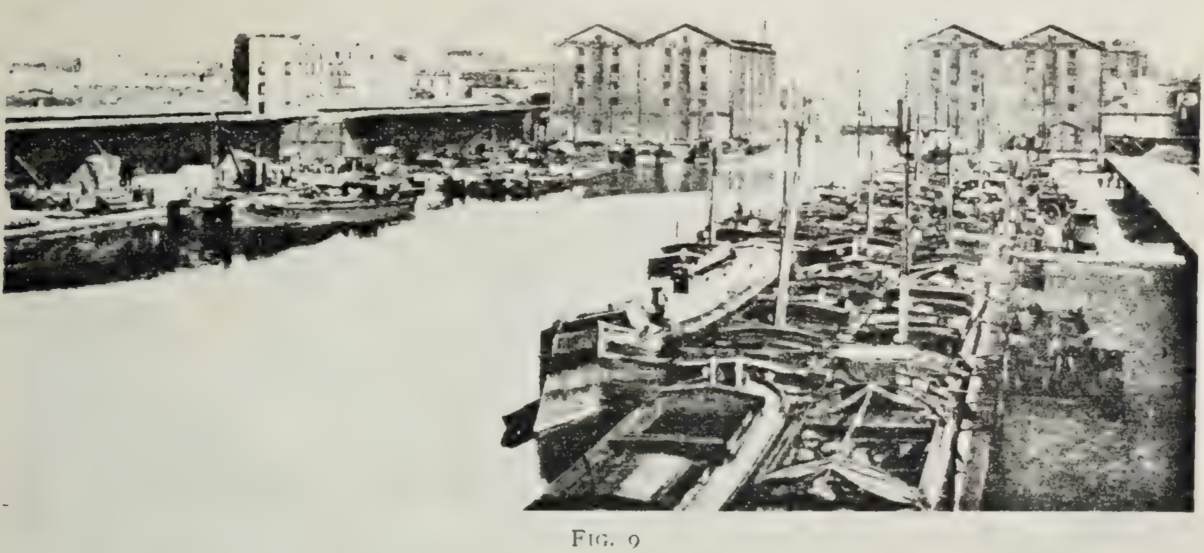

Fig. 9

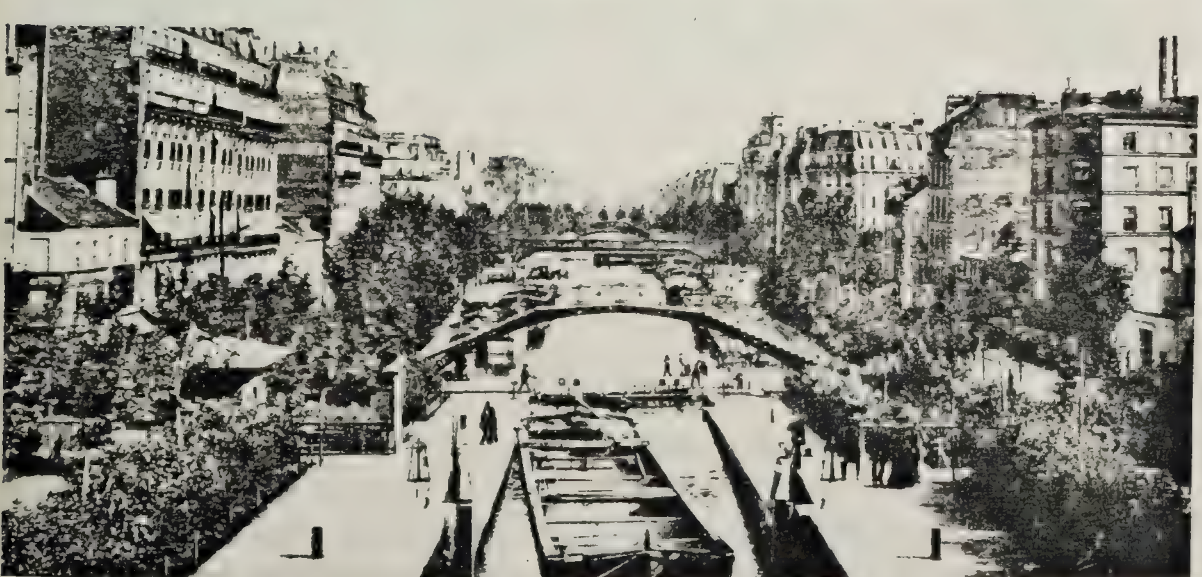

Fig. 10

Fig. 8—View of the Seine looking up stream from Notre Dame: on the right the quai St. Bernard (wine). Compare with Fig. 5.

Fig. 9—The Villette basin at the junction of the Ourcq, St. Denis, and St. Martin canals: a busy industrial section.

Fig. 10—On the canal St. Martin.

When the railroads had taken over the expediting of foodstuffs, and coal had become a necessity of everyday life, the course of traffic altered in favor of the lower Seine and its tributaries by which came the latter commodity. Table II shows the origin and destination of Paris consignments for the year 1912.

Table II calls for some comment. The commercial tributaries of the port of Paris should be divided into two groups: those upstream (Marne, Yonne, upper Seine), which supply 49 per cent of the total traffic (39.6 per cent of the arrivals and 59.4 per cent of the shipments); and those downstream (lower Seine and Oise), which are responsible for 40.6 per cent of the total traffic (54.2 per cent of the arrivals and 27 per cent of the shipments).[2]

The upstream tributaries of the port of Paris are the upper Seine, connected with the Loire by the canals of Loing and Briare; the Yonne, connected with the Saône by the canal of Bourgogne; and the Marne, connected with the Meuse, Moselle, and Rhine by the Rhine-Marne Canal. Their commercial importance does not correspond with their position on the statistical table, for more than 75 per cent of their traffic is limited to the part of the Seine lying between Paris and Montereau. Materials shipped along this section are chiefly building materials from the quarries sent down to Paris, and refuse from Paris carried up the river and dumped into the excavations made by the quarries. If to these are added similar cargoes on the Marne and Yonne, together with the refuse carried by all these rivers, the resulting figures give 90 per cent of all the heavy shipment. The remaining 10 per cent includes wood from Champagne, Bourgogne, and Lorraine, the products of the smelters and ore mines of Lorraine, German coal, wines and foodstuffs coming from the east and center—all consigned to Paris. Shipments out of Paris in this direction are so few as to be negligible.

The downstream tributaries of the port of Paris are of much greater importance. The lower Seine receives all export and import trade by way of Havre and Rouen. The upper waters of the Oise are in touch with the coal-mining regions of northern France and Belgium; the river empties into the Seine at Conflans, 72 kilometers below Paris. By these two waterways alone Paris received, in 1912, 2,259,423 tons of coal coming from the northern districts and 1,294,455 coming from England—a total of 3,553,878 tons. Coal constitutes three-fifths of all products received from downstream. The Oise is the special route for coal from the north. Besides the coal, the river carries only 150,000 tons of building materials, 20,000 tons of wood, 30,000 tons of castings and iron ore, and 70,000 tons of sugar and molasses.

The value of the lower Seine as a commercial trade route is greater still. First and foremost it is 3.2 meters deep—deeper than any other waterway of the basin—and can accommodate vessels of much greater draft; next it reaches ocean trade through Rouen and Havre. To Havre comes merchandise brought by ships from overseas, to Rouen heavier cargoes brought by the international coasting trade. Rouen, really the outport of Paris, is the point where transshipments of cargoes are made. It may be said that during the war Rouen saved France, for located far from the battle line it was able to send up to the factories of Paris the coal that France so badly needed. In 1917, 6,206,000 tons of freight, of which 4,568,000 were coal, went up the Seine from Rouen to Paris.

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[2] Not including the Ourcq, which brings to Paris building materials and wood from a small region to the north of Paris but whose upper end has no outlet. This stream is really part of the port of Paris.

CONCLUSION

The entire character of the port of Paris makes it a local port, chiefly used by and for the great city. The enormous proportion of the incoming freight is made necessary by the diverse requirements of the huge urban agglomeration that consumes large amounts of heavy merchandise but produces almost none.

FIG. 11—Ile de la Cité, site of the first foundation of Paris.

But must this port always be confined to local uses? Can it not enlarge its commercial scope? Why should not Paris become a forwarding port? Why should not certain kinds of merchandise be shipped to Paris to be sent further on, rail freight transferred to the water, water freight to the railroads there? This idea of further developing its commercial usefulness is not a vain dream. Paris, purchasing many products in tremendous quantities, establishes a market for those products within her borders. She receives more than she herself requires and can reship and resell. There are already some goods that Paris re-exports, often to great distances; wine from the warehouses at Bercy, sugar, wood, coffee, charcoal, grain, some few articles made of iron, tools, and machinery. When the day comes when cold storage meats can be brought up from the maritime ports by river boats the meat markets of La Villette can widen their range of distribution.

This idea of making Paris a great transshipping port whose power and influence would be felt even abroad was talked of in earlier days. In 1832 a law authorized the erection of bonded warehouses in the interior of France. Merchandise was to be received there in bond, duty to be paid only if the goods were sold in France. If they were sent out of the country again they went out free. At Paris, on the banks of the St. Martin Canal the Marais Warehouse was built, where copper, coffee, cocoa, pepper, lead, precious woods, sugar, and gums were stored. The idea was principally to make Paris the port of shipment between the ocean and the Rhine countries.

Such a scheme, however, cannot be carried out by money alone. The enormous sums at the disposal of the Parisian trade are not enough in themselves to set up trade currents. Swift, powerful means of transportation are necessary to attract trade in transit. Merchandise now going to the Rhine countries has at its disposal means of transportation with which the Seine cannot compete, the Scheldt to Antwerp, the Rhine to Mannheim, Strasbourg, and even to Basel. In order to become an important port for transshipping and re-forwarding, Paris needs to become a deep-water port, where the railroads and river craft can be brought directly in contact with ocean-going ships. It should become the terminal for the one kind of shipment and the starting point of the other.

The dream of a port of Paris with an anchorage depth of 6 or 7 meters seems abandoned. But a more modest scheme for a depth of 4.5 meters would give considerable chance for hastening this desired improvement in commercial relations. Many things could be brought to Paris directly, both by coasting vessels and ocean-going craft—English coal, American grain, oil from the United States, wood and paper pulp from Scandinavia and Canada. The ships arriving laden at Paris would take on a return freight of chemical products from the east and of iron ores from the Lorraine basin. The profitable exchange between coal and iron cargoes that has made fortunes for shipping in other parts of the world, on the Great Lakes in the United States, on the German and Dutch Rhine, and the British coast for example, would be made possible for French shipping. Eastern France would have a new outlet to the sea through French territory; the influence of Paris would be felt throughout Central Europe, and France would be able to avail herself to the utmost of her splendid geographical position which makes her a passageway between maritime Europe and the interior regions.

ON ESKIMO STONE ROWS IN GREENLAND FORMERLY SUPPOSED TO BE OF NORSE ORIGIN

By Morten P. Porsild
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In the following article will be described certain stone rows occurring in Greenland. They were once considered to be remains of structures built by Norsemen in ancient times, but they are without doubt of Eskimo origin. Inasmuch as one kind of such rows, the *nangissats*, have not hitherto been found outside of Greenland, it appears worth while to call them to the attention of American ethnologists and geographers. The other kind, fences used in deer hunting, are probably very common in Arctic America but are extremely rare in Greenland.

Nangissats

Previous Mention in Literature

In Kleinschmidt's dictionary of the Greenland dialect of the Eskimo language (1871) we find:

> *nãngivoq*, he hops (i. e. makes a single leap on one leg).
> *nãngissarpoq*, he is hopping (iteratively).
> *nãngissat*, big stones, found in various places lying on level ground with considerable intermediate space. They are ascribed by tradition to the old Icelanders, who are said to have placed them for leaping on them on one leg right through the whole row.[1]

In the dictionary of O. Fabricius (1804) we find only the word *naingirsarpok*, "he hops on one leg." As far as I am aware the word *nangissat* is mentioned for the first time by C. L. Giesecke in his "Bericht einer mineralogischen Reise in Grönland (1806–13)." As this work was not published till 1878 (2nd edit., 1910), Giesecke's remarks could not have been known to Kleinschmidt, who lived and worked in Greenland and had no access to libraries or archives. The passage by Giesecke follows.

> Diese Stelle, von den Dänen *Halteplads* oder Hinkstelle genannt, hat ihren Grönländischen Namen, Naingirsaet, von einem ehemals sehr gebräuchlichen Nationalspiele erhalten. Die Spielenden mussten nemlich in gerader Linie nach einem Ziele, welches mit einem Steine bezeichnet wurde, auf einem Beine hüpfen oder hinken. Welcher nun am besten oder weitesten hüpfen oder hinken konnte, gewann den Preis. Man sieht noch auf dem Plazze lange Reihen solcher angelegten Steine. Sodann versuchten sie ihre Stärke im Häckeln oder Finger- und Armziehen, auch im Ringen, worauf das Schlagen mit der flachen Hand

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[1] Samuel Kleinschmidt: Den grönlandske Ordbog, Copenhagen, 1871, p. 234. All Danish quotations in this article are in translation.

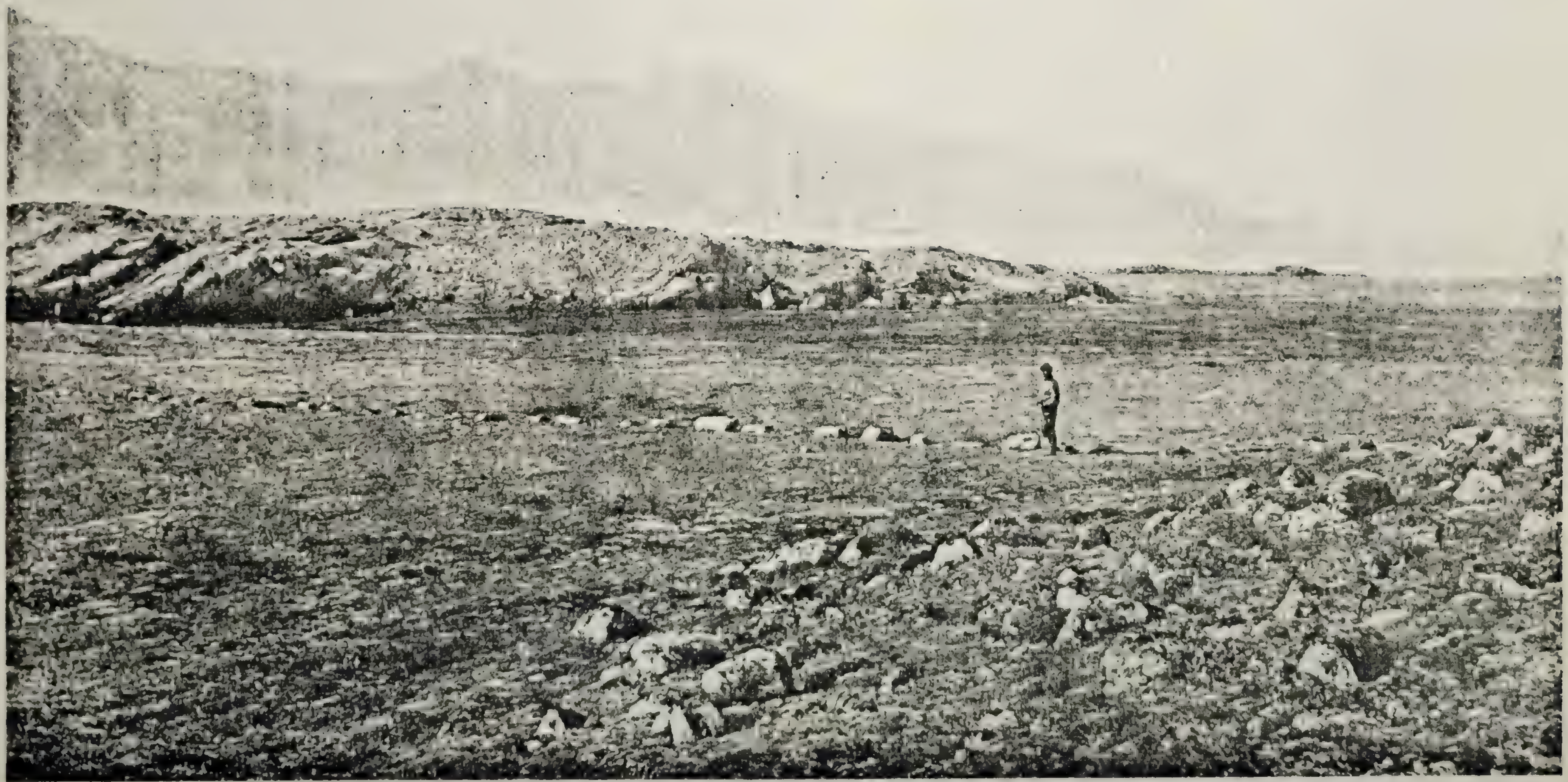

FIG. 1—The *nangissat* in Disko Fiord, Disko Island (lat. 69° 27′ N.; long. 53° 41′ W.). The stones are laid out on a sandy neck of land behind a low gneissic headland. (Photograph by K. J. V. Steenstrup.)

auf die aufgeblasenen Wangen folgte. Hierauf wurde Wettrennen zu Wasser mit Kajaks und Umiaks gehalten, wobei manches der letztgenannten Fahrzeuge, wenn man nach dem Strande zurannte, in Trümmer gieng. Der Beschluss wurde gewöhnlich mit Balliarspiel und Streitgesängen gemacht. Noch vor 10–15 Jahren übten sie sich im Nördlichen Grönland in dergleichen Spielen, welche nun nach und nach aus der Mode kommen, und dem verderblichen Kartenspiele Platz machen.[2]

The place mentioned by Giesecke is, like several others, still called Nangissat and is still normally inhabited. It is situated on a small sandy neck of land behind a protruding rocky naze on the northern coast of the southern branch of Disko Fiord on Disko Island. The place was also described later by Steenstrup[3] who thus expresses his opinion on the origin of the *nangissats*:

> There thus exists no evidence of those stone rows being known to other Eskimo tribes or to the ancient Icelanders. But as the *nangissats* do occur in the northern parts of West Greenland, where the ancient Icelanders never settled, and as there is no reason for assuming that they have been constructed during their transitory summer visits, it seems most probable that the *nangissats* originate from a specific Greenlandic game now forgotten. It is not credible that this game was in use up to Giesecke's time, as it then, without doubt, would have been mentioned in the earlier literature.[4]

With these quotations the references to *nangissats* seem to be exhausted, with the exception of the doubtful cases mentioned below.

Description of Some "Nangissats"

The *nangissats* seen by the author of this article are all situated on somewhat elevated, nearly level ground in the neighborhood of settlements or summer camp sites. The places are generally quite exposed to the prevailing wind, and consequently the ground is bare of vegetation in summer and of snow in winter, being covered with coarse sand or gravel (see Figs. 1 and 2).

Most frequently the stones are placed in a single straight line. They are usually about as large as could be lifted by a strong man, and their weight alone is sufficient to keep them in place when hopped on. But often for lack of stones of suitable size smaller ones have been used. Their upper surfaces are comparatively smooth. The distance between the stones does not vary much, being ordinarily little more than half a meter. I could easily hop from one stone to another, but I always found it wearisome to hop over a large number. I have counted as many as 70 stones in a single row.

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[2] C. L. Giesecke: Bericht einer mineralogischen Reise in Grønland (1806–13), Copenhagen, 1878. 2nd and complete edit. in *Meddelelser om Grønland*, Vol. 35, 1910, pp. 1–478; reference on p. 460.

[3] K. J. V. Steenstrup: Beretning om en Undersøgelsesrejse til Øen Disko i Sommeren 1898, *Meddelelser om Grønland*, Vol. 24, 1901, pp. 249–306. Steenstrup quotes the above given passage by Kleinschmidt, briefly refers to Giesecke's opinions, and remarks that neither the word *nangissat* nor the game for which the stone rows were intended has been mentioned by Hans Egede or his sons, nor by D. Cranz. He also states that nothing corresponding from East Greenland is known to Mr. G. Holm and that neither Mr. G. Holm nor Mrs. Signe Rink knows the word or the game from the Eskimo tales familiar to them. On the other hand the *nangissat* is quite unknown in Iceland either from present day evidence or from the ancient literature.

[4] *Ibid.*, p. 293.

Sometimes the conditions of the ground were not suitable for one long row, and the *nangissats* have then been laid out in other forms. I have seen rows forming two or three sides of a rectangle. In one case (Nivâq Bay) the row terminated in a sickle-shaped hook. Another (which I have not seen) is reported to have the form of a cross (Fig. 4). According to my informants the last-mentioned was subsequently rebuilt "because it was too difficult," i. e. the original distances between the stones were too great. At Igdlutalik there were two rather short *nangissats* of big stones for "grown-ups," as I believe, and a third one of smaller stones and with shorter distances, for children.

USE OF THE "NANGISSATS"

Nowadays the game of hopping on stone rows is never played either by children or by adults. When accompanying travelers, however, our Greenlanders will, just for fun, hop over some of the stones, so as to demonstrate a knowledge of their meaning. In old times, however, the game belonged to the rather large number of sports and contests engaged in either as a pastime among the villagers, or as challenges to strangers, or during the annual feasts when controversies were settled by juridical drum songs.

Local tradition exactly agrees with the description given by Giesecke in the above-quoted passage, although the game was not played at all in his day. My informants relate that the player also had to carry a weight in his arms, such as a bundle of sealskins, the dead body of a small seal, or a live dog.

THE DISTRIBUTION OF "NANGISSATS" IN WEST GREENLAND

Between the 67th and the 72nd parallels of West Greenland *nangissats* are quite common. Indeed, I am inclined to believe that here every larger settlement or camp site from ancient times may have had its own *nangissat*. The accompanying map shows the location of those known to me personally or by reliable verbal or written reports. I have not heard of the existence of *nangissats* north of the 72nd parallel, and from two places, Ikerasaq (72° 13′ N., 55° 7′ W.) and Söndre Upernavik (72° 9′ N., 55° 53′ W.), I have had direct information of their absence. From South Greenland, south of the 67th parallel, *nangissats* have never been reported by any of the numerous Danish traveling scientists or resident officials. In Unartoq Fiord, however, near the colony of Julianehaab, Giesecke has seen "ein von den alten Normännern aus Steinen in die Erde eingelegtes Kreuz."[5] From this very brief description it is not clear whether the cross lies near ancient ruins of Eskimo or of Norse origin, or whether the situation of the stones, their sizes, and the distances between them would permit the use of the cross as a *nangissat* or not. But, as cruciform *nangissats* do occur elsewhere I prefer to consider the above-mentioned stone cross as a *nangissat*, at least until further investigation proves the contrary.

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[5] Giesecke, *op. cit.*, p. 210.

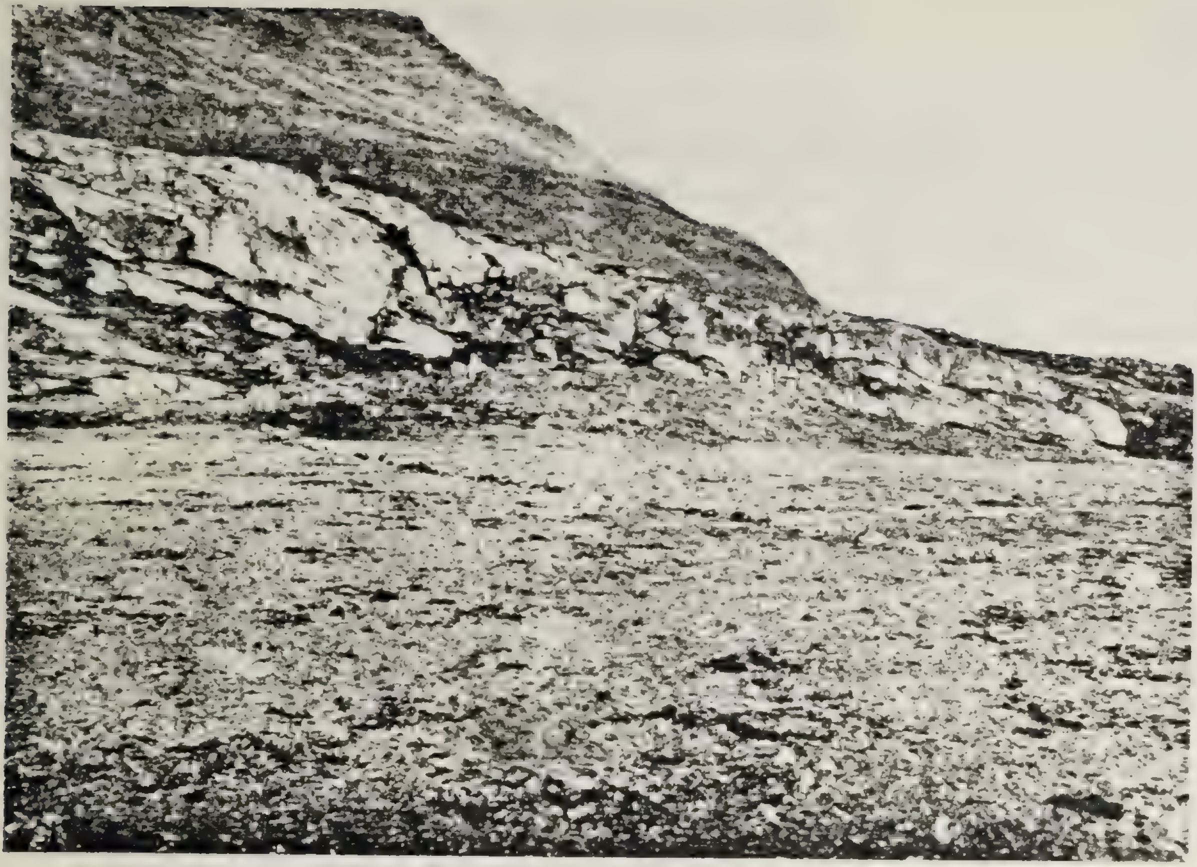

FIG. 2

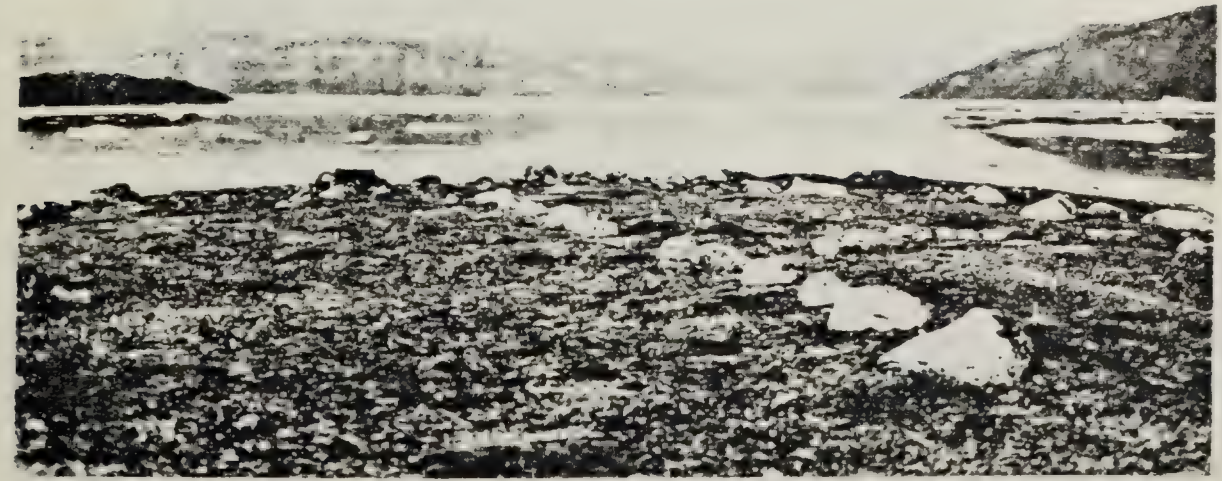

FIG. 3

FIG. 2—Another view of the *nangissat* shown in Figure 1. (Photograph by Morten P. Porsild.)

FIG. 3—Two of the *nangissats* on the islet of Igdlutalik (lat. 69° 53′ N.; long. 50° 33′ W.). The one is of big stones for use by adults, the other of smaller stones for use by children. Eskimo graves are seen at the end of the stone rows. In the background is part of Atâ basin filled with calving ice from the Torssukátak ice fiord. (Photograph by Morten P. Porsild.)

It is possible that a more careful investigation of other parts of Greenland would reveal a wider distribution of *nangissats*. If, on the other hand, they should prove to be restricted to the regions about Disko Bay and Northeast Bay, this fact in itself is sufficient to account for their omission by the earliest writers—the Egedes, father and son, Cranz, Dalager, Glahn, etc.—as they all lived in South Greenland, and their knowledge and experience were confined to that part of the country.

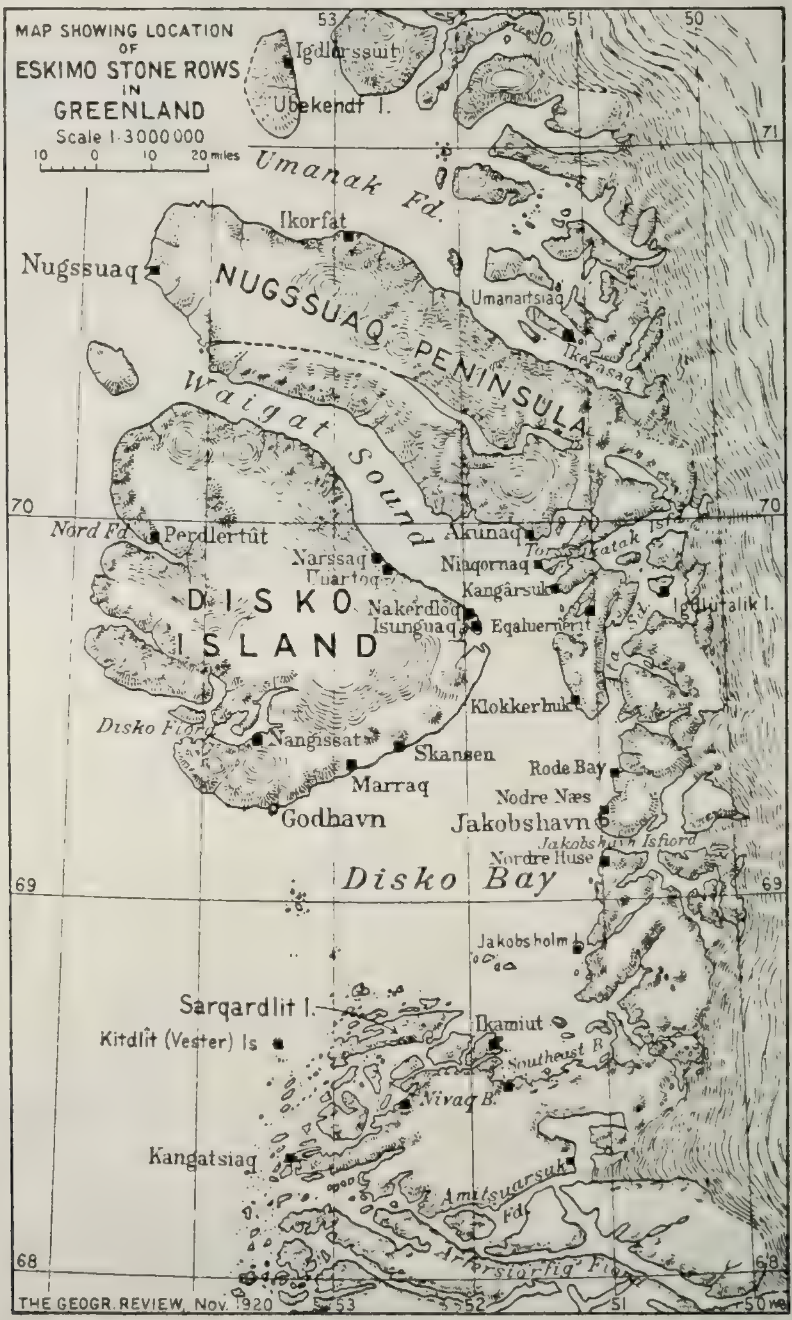

FIG. 4—Map showing distribution of *nangissats* in West Greenland constructed from data supplied by the author. The locations of all *nangissats* known to the author are here shown with the exception of that on the southern coast of Sarqardlît Island.

Kleinschmidt too lived in the southern part of Greenland. If he had lived about Disko Bay or gathered his information from people there, he surely would never have assumed a Norse origin for the *nangissats*. Their occurrence at the ancient settlements of pure Eskimo origin is sufficiently decisive even if one might be inclined to discredit, to a certain degree, the traditions of the Greenlanders. Nevertheless it is rather remarkable that the game of *nangissat* was not mentioned in the West Greenland tales, at least as far as we know them in the collections edited by Rink. Yet in this matter further information may be expected as the stock of West Greenland tales is by no means exhausted.

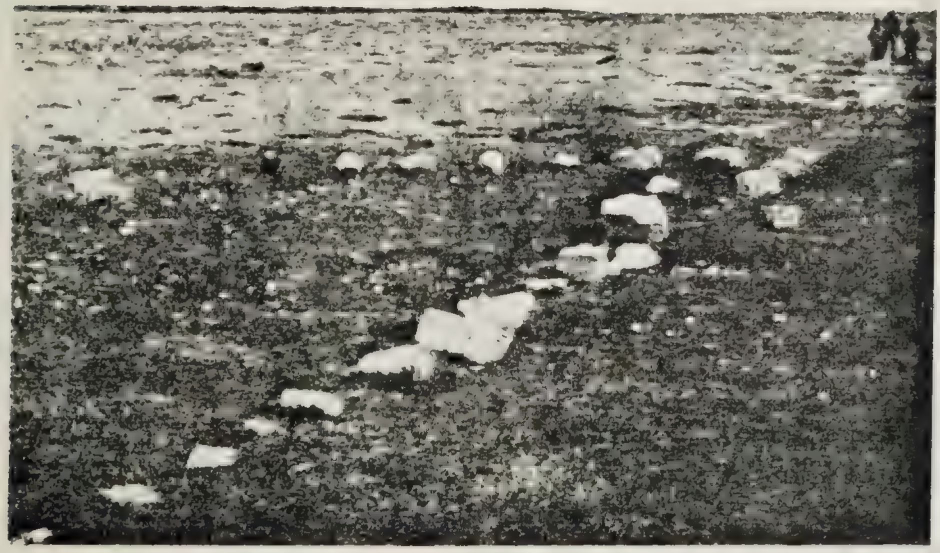

FIG. 5—Part of the cruciform *nangissat* at Ikorfat, on the northern side of the Nugssuaq peninsula. (Photograph by Mr. J. P. Ravn.)

ARE "NANGISSATS" A PROVINCIALISM IN ESKIMO CULTURE?

Nearly every article on Eskimo culture ends with a strong emphasis on its remarkable unity—on the similarity of language, tales, traditions, religion, folklore, as well as of tools and hunting implements and methods among a widespread people. Numerous features at first believed to be peculiarities or provincialisms confined to a restricted area have by closer investigation proved to have a far wider range. This may prove to be the case in the present matter. If, on the other hand, future investigation should fail to find *nangissats* outside of Greenland, we should be forced to regard them as a true provincialism. A recognized provincialism in the culture of the Greenland Eskimos is the occurrence of the so-called feathered harpoon shaft, the *ernangnaq*, together with the common form, the *unâq*, also known elsewhere. At the present time the two forms of shafts have by intercourse become scattered all over the coasts of Greenland; but probably they were invented at different times by different and detached bands of immigrants to Greenland, who had to reconstruct their kayaks and implements for their use, after the long wanderings through icebound regions where kayaks could not be used[6]. The sport of hopping on stone rows may perhaps have originated somewhere near Disko Bay and spread from there northward and southward, later to go out of fashion.

Saputit

Previous Records

The Greenland Eskimo word *saputit* is derived from the verb *sapivâ*, "he confines it," and signifies "means for confining," or, generally, "a fence," "a hedge." Ordinarily the word is used for a dam or a fence of stones across the mouth of a trout river.

However, on the southern coast of Nugssuaq Peninsula, near the settlement of Akúnaq (69° 52′ N., 51° 30′ W.), a fence is found of an extraordinary size. Therefore the word *saputit* has come to signify the whole region around the spot. When, in 1915, the Danish historian Dr. Louis Bobé went to Greenland to investigate the remains of early Danish colonization, the natives guided him to Saputit, with the suggestion that the stone fence there might originally have been a sort of defensive structure erected in ancient times when hostilities were supposedly carried on between the Eskimos and Norsemen or Dutch or British whalers. Having investigated the fence, Dr. Bobé called my attention to the place, which was previously unknown to me, and put his notes and sketches in my hands. On my return from a trip to the vicinity during the fall of 1915, I paid a short visit to Saputit. Unfortunately I had then used all my films and therefore was not able to take a photograph of the fence.

The place has been mentioned in literature also by Giesecke: "Wir sezzten über die Bucht Saputit, so genannt von den kleinen Steindämmen, welche man hier beym Bergstrome des Lachsfanges wegen legt."[7] This remark of Giesecke shows that he knew the general meaning of the word, but it also implies that he did not land there or see the fence in question at all, as will readily appear from the description of it given below.

Description of the Locality

The bay at Saputit (Fig. 5) is not shown on any of the existing maps. It is rather spacious, extending from the coast line northward and continued inward by two valleys, divided by a high and steep hill, Ingigsoq. The eastern side of the bay is formed by a somewhat steep rocky hill whose name, Orpigarssuit, Dr. Bobé made note of. This name, meaning "the remarkable big thickets," cannot belong to the cliff, as any growth of willow thickets is impossible there, and so probably refers to the lowland lying north of the cliff. The western side is a low foreland covered with vegetation, about one kilometer broad, ending abruptly on the west at the steep side of another cliff. For this cliff Dr. Bobé has recorded the name Palutugataq. In this form the word has no meaning; probably it is derived from *patdlugut*, "the handle of the Eskimo's adze," or from the verb *patdlungavoq*, "he lies on his belly with raised head." Without doubt the name refers to some contour of the rocks. At the shore of that foreland is a small rocky head protruding into the bay, called Niaqornarsuk. Somewhat inside Niaqornarsuk the fence extends in a nearly straight line from the shore across the foreland towards the foot of Palutugataq.

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[6] M. P. Porsild: Studies on the Material Culture of the Eskimo in West Greenland (Arbejder fra den Danske Arktiske Station paa Disko, No. 7), *Meddelelser om Grønland*, Vol. 51, 1915, pp. 111–250; reference on p. 121.

[7] Giesecke, *op. cit.*, p. 359.

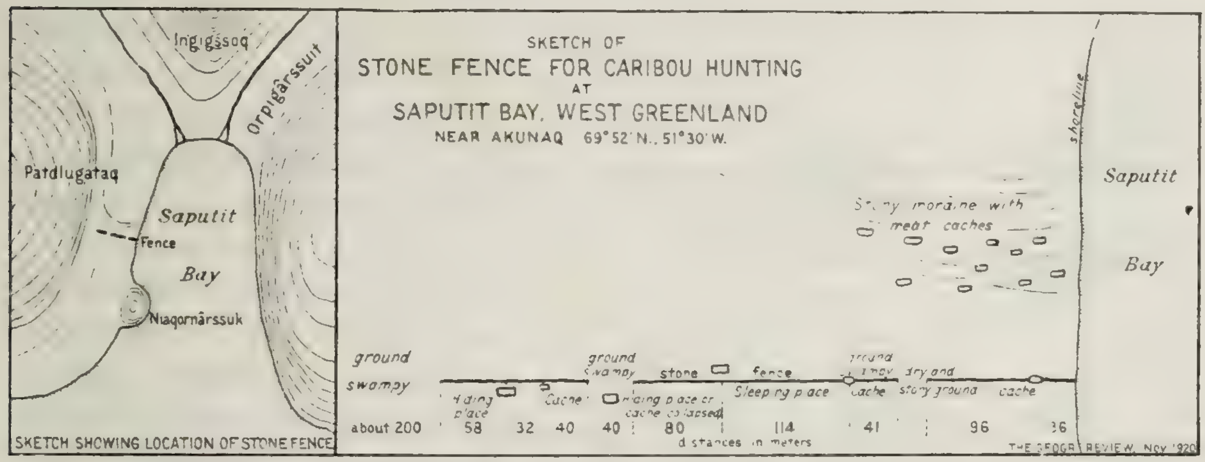

Fig. 6—Sketch of fence for caribou hunting at Saputit Bay. (After a drawing by the author. The spelling of place names follows that of the original sketch.)

Description of the Fence

The fence was made of both large and small stones. Numerous large rocks, either stationary or too large to carry, are built into the fence, slightly modifying its straightness. All the stones are of a rather schistose gneiss, mostly flat in form. As far as possible they are set on edge; and it is very plain that the builders did not aim to construct a solid fortification, but only something that should serve as a place of concealment. Sods have never been placed between the stones, and consequently numerous interstices are to be found. Even the strongest man could hardly have managed by himself to carry the biggest transported stones; they must have been rolled into position. A few meters inside the fence a terminal moraine stretches across the foreland. At some earlier time the finer materials of the moraine were washed out by the sea, the stones being left. The fence builders purposely chose the border of that stone heap as the place for their work;

here the suitable stones in the immediate vicinity are exhausted, but a little farther within the fence there is still a wealth of loose stones.

In the main the fence is quite undisturbed, standing as it was at the time of its construction. In some places, however, the stones were rather small, and there the fence has partly collapsed. Its average height is one meter, but no absolutely uniform height was intended. The fence follows the roughness of the ground, the highest point of it lying some 20 meters above high-water mark. At present the shore here, as elsewhere in West Greenland, is rapidly sinking.

Along the fence, or sometimes into it, numerous square hiding places or sleeping shelters of stones raised on edge have been built. In addition there also occur several caches of solidly and closely laid stones. In the fence itself there are some gaps or interstices where no stones have ever been set. Near the shore are numerous caches on both sides of the fence, and still more on the stony moraine. Along the shore outward are numerous sleeping places and tent rings; also an old path may be discerned, and at Niaqornarsuk camp sites of modern origin are to be seen. Details of the fence, which runs from a point about 200 meters eastward from the steep western cliff to the shore line, are given in the accompanying diagram.

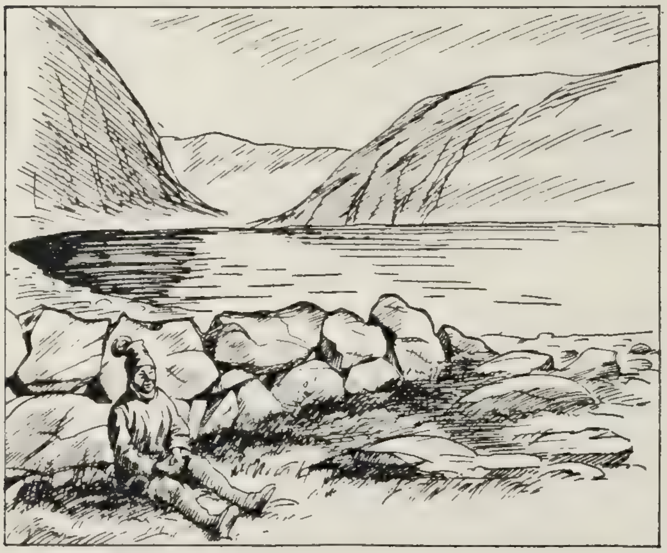

FIG. 7—The seaward end of the fence shown in Fig. 6. (Drawn by Miss Ingeborg Hydahl after a sketch by Dr. Louis Bobé.)

THE PURPOSE OF THE FENCE

There is no doubt, the size, form, and environment being considered, that the fence was intended for caribou hunting, like similar fences in Greenland and elsewhere. The caribou were driven through the two valleys towards the head of the bay, and here they followed the foreland on the western side to the fence behind which were concealed the hunters with their bows and arrows. In spite of the weakness of its construction, the caribou were not able to leap over the fence but were forced through the gaps where they were shot or whence they took to the water where their lancing from kayaks was easy.

At the ice fiord of Jakobshavn, which lies about one degree of latitude to the south, traditions exist among the present population of their ancestors hunting caribou in the environs of Saputit. Before the Danish colonization perhaps the largest settlement known in Greenland was at Sermermiut close to the ice fiord.

AGE OF THE FENCE

Ordinarily in Greenland every exposed stone surface is covered with a dense growth of black lichens. Apparently the stones of the fence have been placed so that their black sides faced inland, the bare ones facing the sea. At the present time lichens have partly crept around to the side originally bare. But the growth of the black lichen crusts is extremely slow in Arctic regions. An example will better illustrate this fact than many words. In the last century Giesecke wrote his initials on a stone on a mountain top in South Greenland simply by scratching off the black lichen growth with his knife. Some seventy years later K. J. V. Steenstrup found the stone, and the scratching seemed to him as fresh as if it had been made but a few days before! From the appearance of the lichen growth alone on the stones at Saputit we may infer a high age for the structure—at least several hundred years. This conclusion is borne out also by the growth of the mosses and grass at the foot of the fence stones, especially on somewhat swampy ground where the snow is late in disappearing. Here the lowest stones were overgrown, often to their very tops.

The fact that the present population seems to have quite forgotten the former use of the fence also proves the work to be of considerable age. The story that it was a defensive construction against Norsemen, Dutch, or other invaders is, for technical reasons alone, quite absurd. Surely this idea must have originated in the brain of some European who had heard descriptions of the fence by the Eskimos without having seen it with his own eyes. Afterwards the explanation was apparently adopted by the Eskimos themselves with their customary politeness. In a quite analogous way the story of the existence of a sound across Greenland in the latitude of the ice fiord of Jakobshavn was originally derived from misapprehensions by the ancient writers, told by the first settlers to the natives, and politely adopted by them.

RARITY OF FENCES FOR HUNTING IN GREENLAND

Whilst hunting fences are quite common in the caribou districts of Arctic America, their occurrence in Greenland seems to be remarkably rare. From the literature of the subject I only know of the following cases.

On the large river at the head of the branch of Ilua Fiord known as Kangikitsoq (near Cape Farewell) between four small hills there is to be found a large arched stone fence; and in the vicinity of it are two square much dilapidated ruins. They were discovered and described in 1778 by A. Arctander and were supposed by him[8] to be of Norse origin, intended for fencing cattle or sheep, although the square house-like ruins were in such a state that nothing certain could be determined about them. But when

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[8] A. Arctander: Udskrivt af en Dagbog, holden i Grønland paa en Recognoscerings Reise i Julianæhaabs District i Aarene 1777–1779. Published by H. P. von Eggers in Samleren, Vol. 6, Copenhagen, 1793. Arctander's description is repeated in the classical handbook of Norse remains in Greenland, "Grønlands historiske Mindesmaerker," 3 vols., Copenhagen, 1838–45; reference in Vol. 3, p. 800.

G. F. Holm investigated and mapped the country here, in 1880, his accompanying Greenlanders declared to him that the fence was intended for caribou hunting and the ruins were those of Eskimo houses.[9]

Another fence, also in arched form, was discovered and described in 1834 by Jacob Arøe. A part of his diary for the trading post of Nanortalik is a description of a trip made in the fiord of Tasermiut in South Greenland for topographic and antiquarian researches. This part has recently been published by H. Ostermann. We read here:

> At the head of the bay [Tasiusaq on the eastern coast of the fiord] *rudera* occur a little above the lake on a low hill, but they are very inconsiderable and quite collapsed, so that it was impossible to form any opinion as to their true character; they were, however, of small size and could hardly have formed more than two houses. In this locality, near the house ruins, was further observed a fence of rather large stones, forming a semicircle down to the shore, about 50 paces long. The proper purpose of this fence was not clear as on the middle of the hill it touched a large rock and did not seem to have formed any inclosure. Small stone walls were also seen on the hill, built close to large rocks, thus forming square spaces of a size of 1 or 2 ells, sometimes with the one side left open, but very insignificant and only one stone high above the ground.[10]

Although the fence here is rather short, there can hardly be any doubt of its having been intended for caribou hunting. The small inclosures behind the large rocks are hiding places or caches.

Finally, we have a case from East Greenland, namely on the island of Kulusuk near Cape Dan, in Angmagssalik Fiord. W. Thalbitzer gives an illustration of it and writes:

> At the one end of a fertile plain, which reaches down to a large inland lake, there is a narrow strait or pass between hills, where we find the remains of the *taalin*, a wall or fence of upraised stones connected with a shooting cover, for use in caribou hunting. The word is the same for the place on Kulusuk and is found as a place name at several localities in West Greenland (here called *talut*), where similar walls occur. In the middle of the wall I have seen there is an opening like a gate, through which the hunted animals have been obliged to take flight. Before the end of the wall are the remains of a rectangular cover in which the waiting hunter lay concealed. I was shown how the animals usually came, from the high slopes in the east, on the way down to the grassy heath and the inland lake. A large detached rock lies out on the heath and behind this a man on the watch conceals himself and signals to the archer in the shooting cover, when he sees the animals approaching.[11]

It may be remarked that the word *talut* in West Greenland really signifies the small square hiding places and not the fences. Hiding and sleeping places without fences are very abundant on all present and former caribou hunting grounds. Of fences for driving the caribou we thus know only four cases altogether.

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[9] G. F. Holm: Beskrivelse af Ruiner i Julianehaabs Distrikt, *Meddelelser om Grønland*, Vol. 6, 1883, pp. 57–145; reference on p. 137.

[10] H. Ostermann: Arkæologisk-topografisk Beskrivelse af Tasermiut-Fjorden in Sydgrønland, forfattet af Assistent Jacob Arøe, *Geografisk Tidskrift*, Copenhagen, Vol. 24, 1917, pp. 75–80; reference on p. 76.

[11] William Thalbitzer: The Ammassalik Eskimo, *Meddelelser om Grønland*, Vol. 39, 1914, pp. 1–755; reference on p. 405.

Scarecrows for Deer Hunting

Hans Egede makes mention of white poles with pieces of sod placed on their tops and planted in rows used as scarecrows by the Eskimos in driving the caribou to the concealed hunters.[12] The hunting is also illustrated in the plate accompanying the description. In the northern parts of the country suitable wood was very scarce, and therefore cairns were used for that purpose. According to verbal information given to me by Mr. E. Anbersen, chief factor of the colony of Upernavik, rows of cairns with hiding places behind them are to be seen on the plateau between the heads of the Umiarfik and Amitsuarsuk Fiords (about 72° 20′ N.). Between these cairns the intervals were from 20 to 30 meters.

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[12] Hans Egede: Det gamle Grønlands nye Perlustration, etc. Copenhagen, 1729 and 1741. English transl., London, 1745 and 1818.

AIRPLANES AND GEOGRAPHY*

By Willis T. Lee
United States Geological Survey

The airplane opens a new world to the geographer, for some parts of the earth's surface can be conveniently observed and adequately illustrated in no other way than from the air. Aerial photography is therefore a new and powerful aid in the study of physical geography.[1] It is well known that aerial photography was used in many ways during the World War. A vast fund of information accumulated then is now available for use in various ways.[2] Aerial photography is obviously of particular value in the exploration and representation of areas that are inaccessible or accessible only with difficulty by ordinary methods, such as some parts of the Coastal Plain of Virginia, Maryland, and Delaware.

General View of the Geography of the Coastal Plain

For the purpose of testing the utility of the airplane for observing country of this character a flight of 200 miles or more was made over parts of eastern Virginia. From Langley Field we rose to an altitude of 3,000 feet, then flew southward over Hampton Roads, Norfolk, and the Dismal Swamp. At Lake Drummond we turned northwestward, passing over Suffolk to James River, which we followed upstream to its great meanders. There we turned northeastward, passing over West Point to the mouth of Rappahannock River, and then followed the shore of Chesapeake Bay southward to Langley Field.

The general impression gained from this flight was much the same as that gained by looking down on a map spread on a table. There was no difficulty in recognizing the objects mapped, such as villages, streams, and roads. Even details like the color of the soil appeared startlingly clear, and it was easy to distinguish the well-cultivated from the weedy fields. Town houses and streets appeared as if laid off by a draftsman's rule. The great complicated framework of steel beams at the Newport News shipyards looked like filigree, but the thousands of men at work could not be seen. Many ocean-going vessels lay at anchor in Hampton Roads, but from our lofty point of view they seemed to be as small as rowboats.

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*This paper is published by permission of the Director of the United States Geological Survey. It is based on observations made possible by the co-operation of officials of the air services of the War and Navy departments. The assistance of Captain Walter R. Lawson, operations officer, and Captain Fred Place, director of the School of Aerial Photography, at Langley Field, is gratefully acknowledged. These officers placed at my disposal their entire collection of photographs, from which many were selected for illustration, both in this paper and in the forthcoming geographic handbook to be published by the United States Geological Survey. Some of the photographs used here were made by Captain Place for this particular purpose. Captain Lawson also interested himself in the investigation and personally piloted me in flights in order to point out particularly good examples of submerged land forms which he had observed. Later, officials of the Navy Air Service at Washington, D. C., extended similar privileges, and I was able to obtain views of the underwater channels and drowned terraces of the Potomac.

[1] The development of aerial photography has been admirably summed up by Herbert E. Ives: Airplane Photography, J. B. Lippincott Co., Philadelphia, 1920.

[2] Compare E. Lester Jones: The Aeroplane in Surveying and Mapping, *Flying*, June, 1919, pp. 438–441, 472.

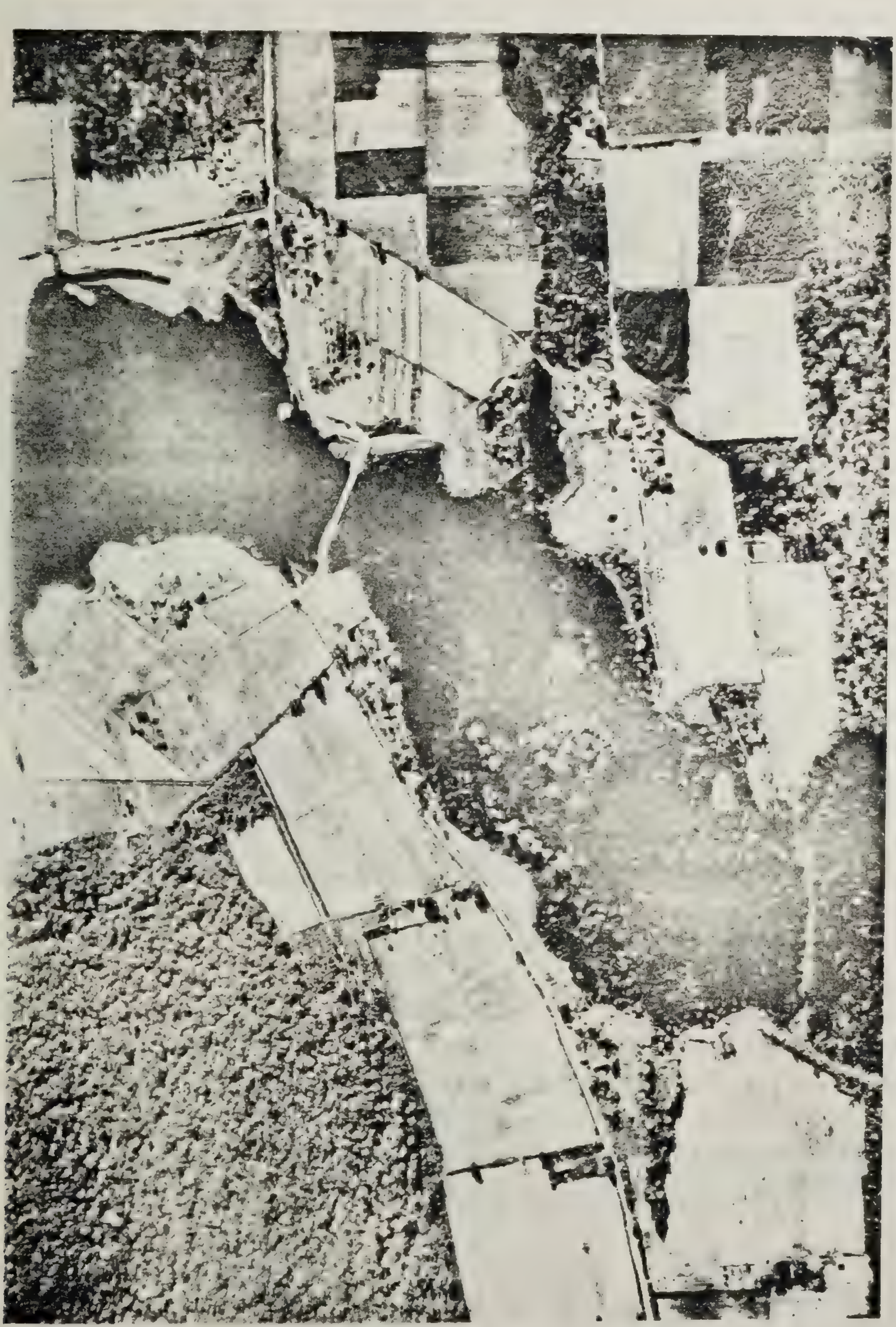


Fig. 1—Vertical view of Big Bethel Reservoir near Langley Field, Va., showing roads, bypaths, and buildings; water in which drowned trees are still standing; cultivated lands (the light-colored plats having parallel ridges); forests and brush-covered lands. (Photograph by U. S. Army Air Service.)

The smoke from Norfolk obscured our vision somewhat while we were over that city, but with our rate of 100 miles an hour we soon emerged from it to find ourselves over Dismal Swamp, which had the appearance of a vast dark-colored monotonous plain. Lake Drummond, the central body of water in this swamp, had the general aspect of a great hole in the plain rather than that of a body of water. Although the water of the lake is dark brown, like the water of the southern swamps generally, the lake bottom was dimly visible. It differed but little in color from the surrounding forest-covered land except that it was mottled with light areas of irregular shape. The general appearance of the lake basin reminded me of the photographs of lunar craters. The Nansemond scarp where the forested swamp gives place to the tilled fields of the higher lands to the west was clearly recognized. Still farther west the country consists chiefly of wooded valleys, "pocosons," and forested plain with here and there a clearing. Near the main streams, however, the flat lowlands are generally cleared and cultivated.

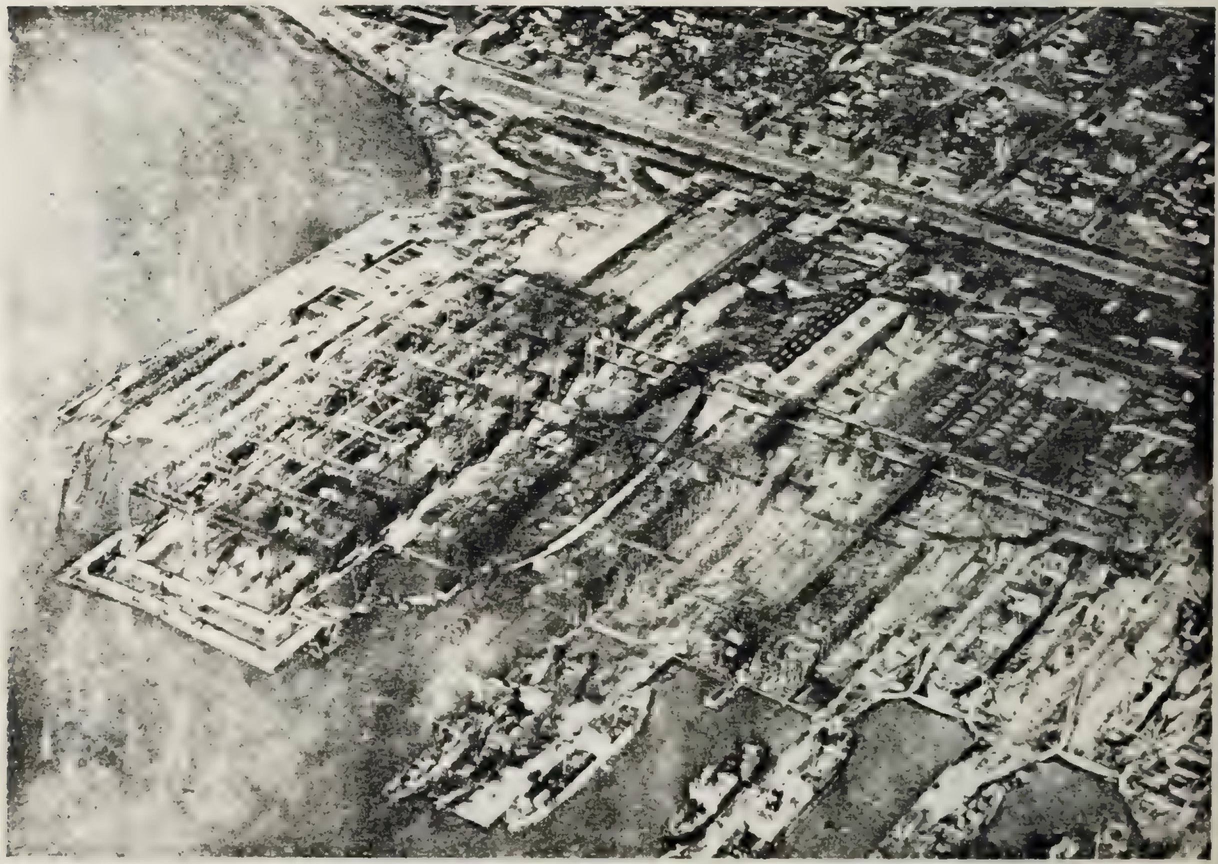


FIG. 2—Newport News, Va., showing city blocks and shipyards with partly completed vessels on ways, in dry dock, and at wharf. (Photograph by U. S. Army Air Service.)

RESULTS OF TRIAL FLIGHT

So much was gained from this trial flight and so vast seemed the possibilities of obtaining, by means of the airplane, new information on the physical geography of the low-lying areas of the Coastal Plain that other flights were made, some for observation and others for obtaining photographs. Some of these flights were made over land, others over water, and still others over such strange middle ground between land and water as the tidal marshes, mud flats (see Fig. 6), and drowned lowlands. Some of the more significant observations relating to these flights and to the uses of aerial photography are here recorded. They may be grouped under the following headings:

1. Observations in well-known areas, such as a city, in which there are many details to be shown.
2. Observations in areas such as a marsh, in which many of the details may be unimportant and are usually omitted from maps and descriptions, because the difficulty of obtaining them by ordinary methods is too great to warrant the necessary expenditure of time and money.
3. Observations in submerged areas, where information as to the underwater surface has been obtained heretofore chiefly by soundings.

DETERMINATION OF DETAILS IN WELL-KNOWN AREAS

It is not the function of this paper to discuss the application of aerial photography to the making of maps, except in so far as maps are incidental to geographic study. But the interests of the map maker and the student of geography are so nearly identical that it is difficult to omit all references to mapping. In fact, the country as seen from a plane high in the air has a striking resemblance to a map. For this reason aerial photographs properly taken and properly interpreted make excellent maps. But just as the reader of a map must know the meaning of the symbols used on the map, so the user of aerial photographs must learn to interpret them. For example, when a photographic print is so oriented that shadows point toward the observer, hollows and hills, buildings and trees appear natural. If the print is reversed, hills may have the appearance of hollows. By practice the observer soon learns distinctive characteristics. Forests are readily distinguished from brush lands, and even the kinds of trees may be recognized by their characteristics of growth. Orchards may be recognized by the even spacing of the trees. Paved roads may be distinguished from secondary roads and byways. Bridges, fords, and a great variety of small objects may be recognized by some distinctive peculiarity.

It is well known that the accurate mapping of a tract which contains many details that are to be shown is very expensive. The cost of really accurate representation on a map of all buildings, streets, and alleys of a city, such as Newport News (see Fig. 2), is almost prohibitive. It is certain that aerial photographs properly oriented by means of points in the photographed area whose locations are accurately determined by the ordinary methods of surveying would supply much of the desired information at less expense. Experiments are now in progress to determine relative costs, as well as better modes of procedure. Aerial photography may also be of use in keeping maps and charts up to date, especially in areas where changes occur frequently, and in supplying details for places difficult to traverse.

Photographs are useful also in an area where it is desirable to show accurately certain details of open country, such as forested areas, tilled lands, and the quality of roads. This can perhaps be best illustrated by an example.

Mapping of the Camp Abraham Eustis Area, Virginia

The excellent topographic maps of parts of eastern Virginia recently completed by the United States Geological Survey show among other things the general distribution of forests with somewhat indefinite outlines. This is perhaps all that is warranted for most areas, but there are places where more accurate information is needed. It might be desirable to know whether an area mapped as forest is covered with large timber or with worthless brush; whether the forest consists of evergreen or deciduous trees; whether the cleared land is cultivated, pasture land, or overgrown with bushes; whether the roads are well-kept thoroughfares or unfrequented byways. It is important to aviators that maps of areas that lie along airplane routes show cleared tracts where landings can be made in safety. Investigations were carried on in eastern Virginia during the war to determine these and other characteristics of the country, for the purpose of coast

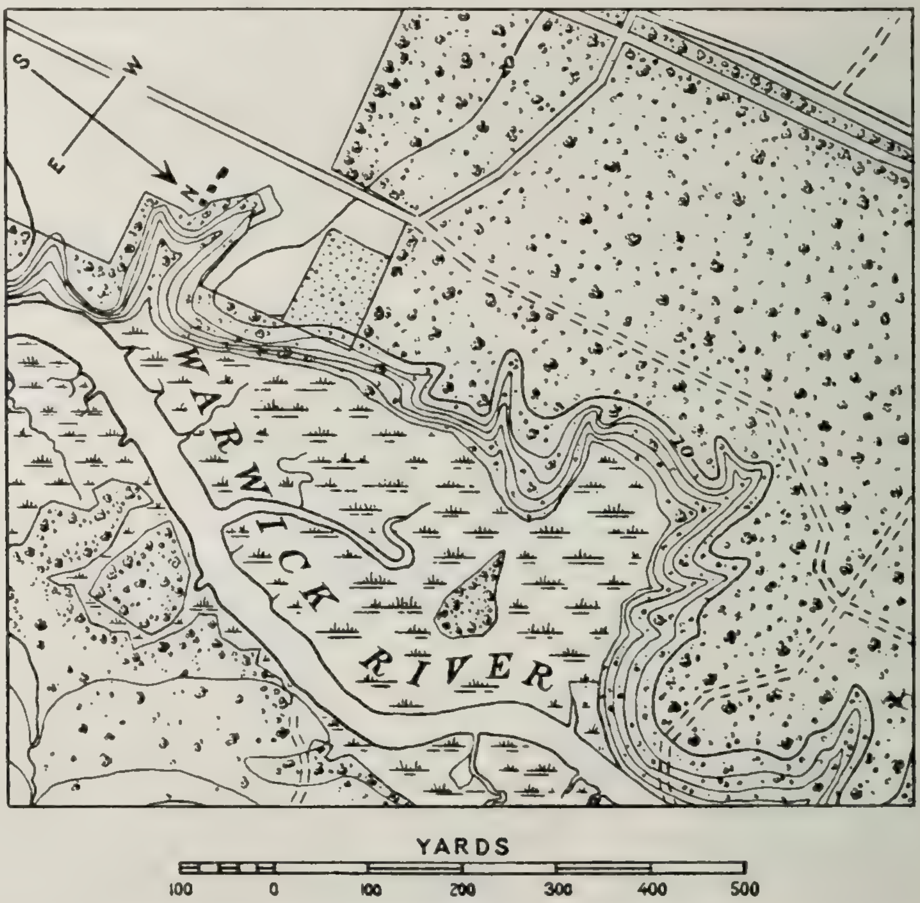


Fig. 3—A part of Camp Abraham Eustis, Va., showing the mapped area represented by the photographs shown in Figs. 4 and 5. Streams, swamps, woodlands, and clearings are seen. The contour interval is 2 meters; scale 1:10,000. Orientation corresponds with that of Fig. 4. (Drawn from Mulberry Island Sheet, No. 2, Corps of Engineers, U. S. Army, Special Military Map.)

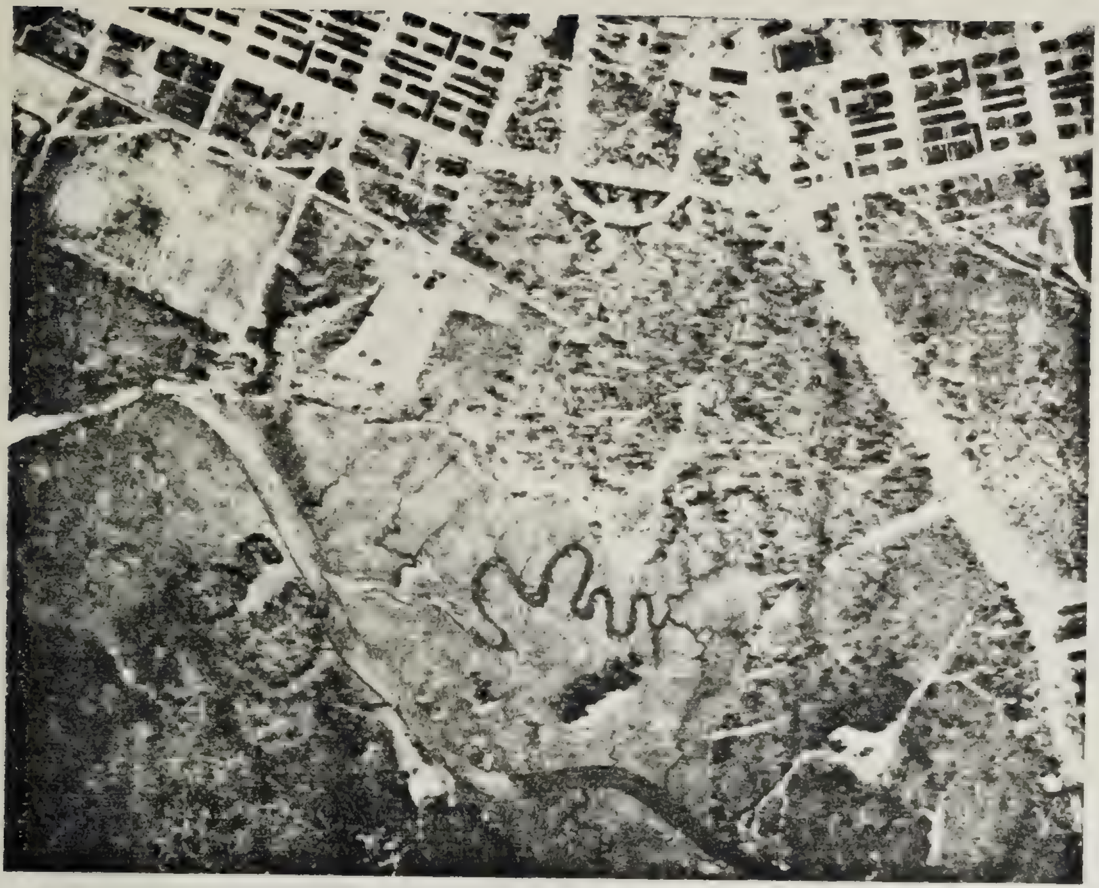


FIG. 4

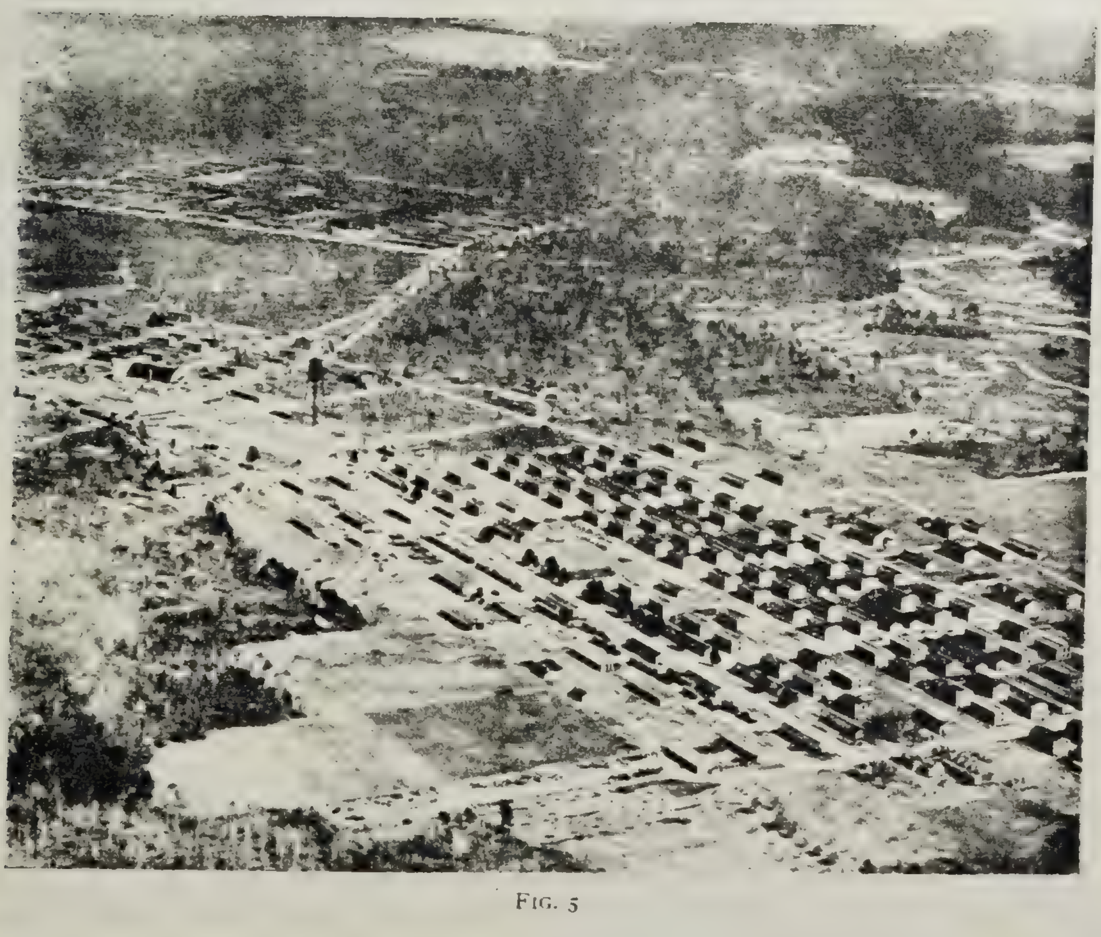


FIG. 5

FIG. 4—Vertical view of a part of Camp Abraham Eustis, Va. This is the area shown in Fig. 3, with which it should be compared. Note the differences in detail, especially as regards the drainage. (Photograph by U. S. Army Air Service.)

FIG. 5—A part of Camp Abraham Eustis, Va., showing in oblique view the area represented by Fig. 3. For orientation note that the meandering stream shown near the bottom of Fig. 3 appears here in the right hand middle ground. To correspond with Figs. 3 and 4 this one should be viewed in reverse position. (Photograph by U. S. Army Air Service.)

defense. Such details may all be obtained by aerial photography with great accuracy and relatively small expense.

To illustrate this point I have chosen the photograph of an area near Camp Abraham Eustis that was mapped with extreme care. This area was mapped on a scale of 1:10,000, or about 6 inches to the mile, and the map shows details with unusual fidelity. The area shown on the part of the map reproduced as Figure 3 was photographed both vertically and obliquely from the air. On comparison of the map with the vertical photograph (Fig. 4) it is obvious that in spite of the detailed character of the map the photograph shows many details that the map does not represent, such as the small streams in the foreground. Many of these details are too trivial to be worth the expense of mapping, but the photograph records them at no extra expense.

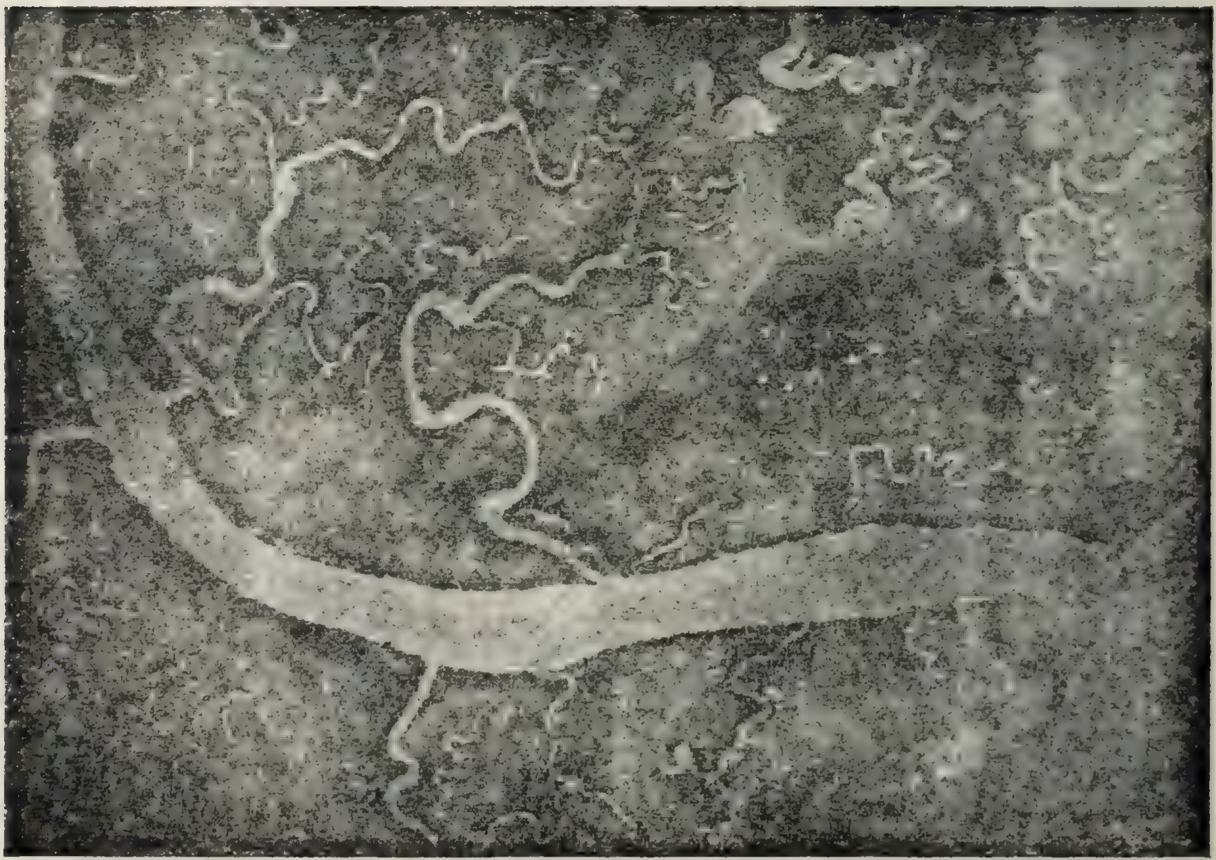


FIG. 6—A mud flat off the eastern shore of Virginia, showing channels in an area submerged at high tide and exposed at low tide. (Photograph by U. S. Army Air Service.)

OBSERVATIONS ON AREAS DIFFICULT OF ACCESS

Some of the marshes of the Coastal Plain consist of soft muck and mud through which it would be foolish to attempt to make one's way. Others are equally inhospitable jungles of reedlike grass and similar rank vegetation. It is not strange that the maps of these marshes do not show great detail. The camera, however, is not concerned with the difficulties that the surveyor might encounter. It represents useful and useless details with equal accuracy. It is somewhat surprising as well as especially interesting to note from photographs of some of these marshes that in addition to the tidal runs or so-called thorofares open at both ends, they have perfectly developed stream systems showing dendritic arrangement with complicated interlacing of branches—beautifully perfect meandering rivers in miniature, a whole system developed on an area of only a few acres.

DETAILS OF A MARSHY AREA

Captain Place photographed some of these marshes during a flight, but unfortunately the weather conditions prevented him from rising more than 2,000 feet, hence the photographs include only small portions of the marsh lands. Figure 7 represents a strip of land about three-quarters of a mile long in the extreme southwestern part of Lee Marsh. This figure may be compared with the topographic map of the same area. (See United States Geological Survey map of New Kent quadrangle, Virginia.) The rounded end to the left in the photograph is the relatively pointed projection of the marsh toward the southwest. The larger stream in the upper right hand corner of the photograph is the same as the one mapped as a winding thorofare through the marsh. The complicated system of drainage shown in the body of the photograph is not represented on the map, and this helps to establish one of the points here emphasized, namely, that aerial photography supplies at no extra expense geographic details which do not warrant the expenditure that would be necessary to map them by ordinary methods.

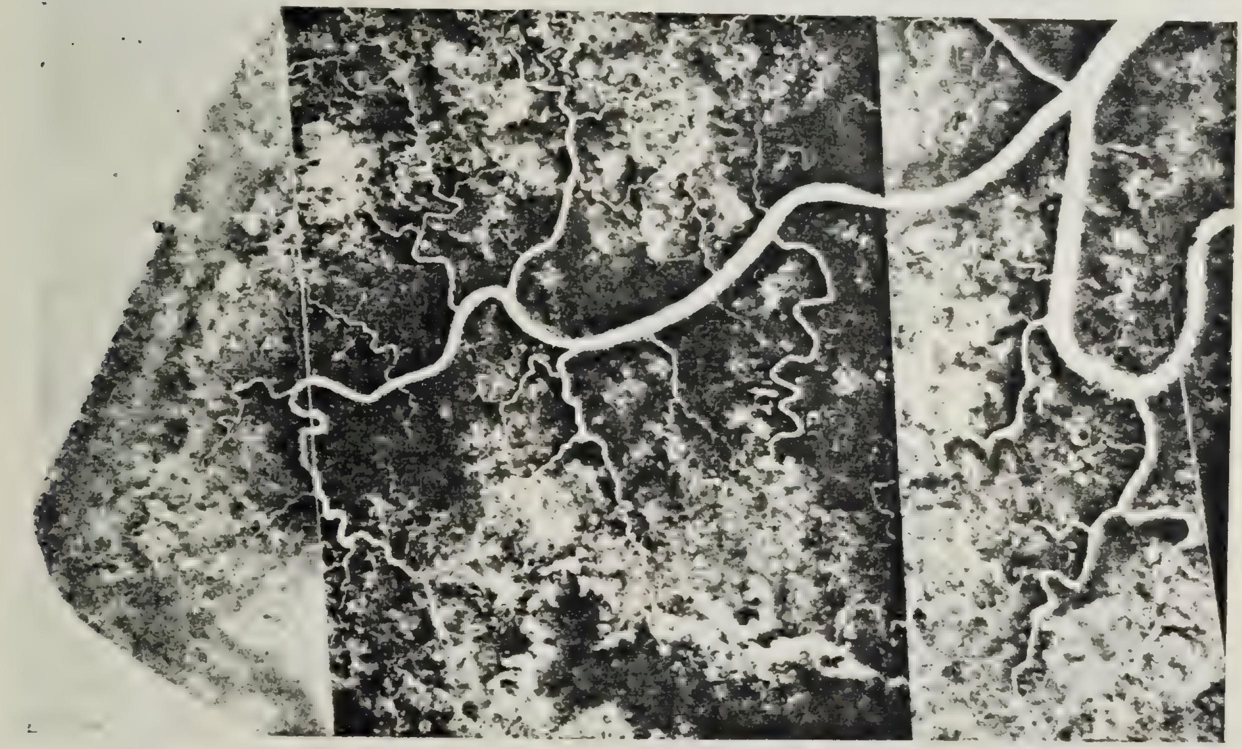
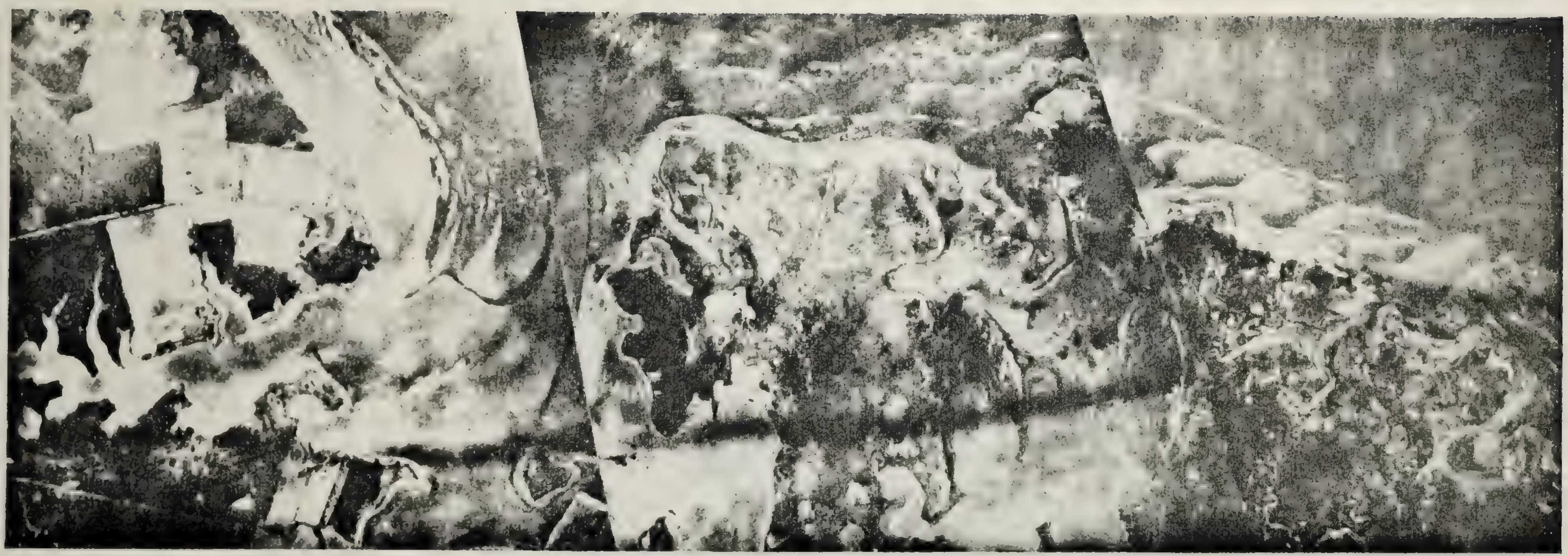


FIG. 7—Aerial view of a part of Lee Marsh near West Point, Va., showing an intricate system of drainage not indicated on existing maps. The straight lines across the illustration are due to the joining of photographic prints. (Photograph by U. S. Army Air Service.)



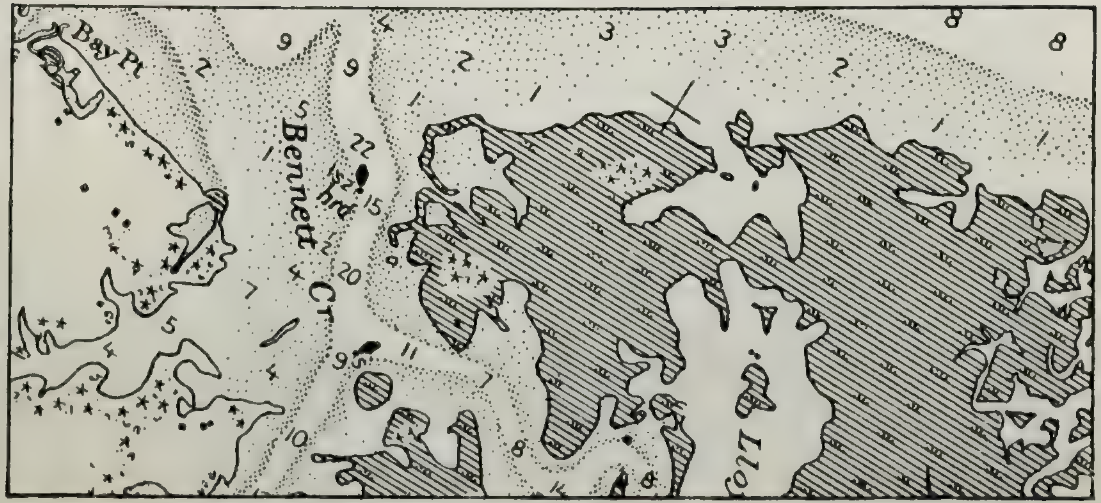


FIG. 8—Above is an aerial photograph of a section of the mouth of the Poquoson River, Va. On the left is seen forest and cultivated land; in the center and to the right marshland. Subaqueous features shown are sand bars, submerged terraces, and inner channels. Sand bars are seen as a light-colored zone of wavy appearance. Currents are longshore, and the bars point upstream. The outer edge of this zone marks the outer edge of a shelf from 3 to 5 feet deep. In the left center it is sharply cut by the navigable channel of Bennett Creek (9 to 22 feet deep) which is clearly distinguished from the submerged shelves on either side. The illustration is made up of three photographs. The diagonal lines across it are due to the joining of the photographic prints. (Photographs by U. S. Army Air Service.) Below is a reproduction of the U. S. Coast and Geodetic Survey chart of the same area.

Other places where aerial photography is useful in supplementing maps and charts are low-lying coasts that are likely to change in form during a storm and areas near the mouth of a stream that is delivering sediment. It is noticeable that in some places shore lines differ from those indicated on maps made several years ago. In some of these low-lying areas there is a wealth of detail that is utterly trivial and would seem superfluous on an ordinary map.

Compare, for example, the photographic reproduction in Figure 8 with the United States Coast and Geodetic Survey chart representing the same area. The photograph covers about a linear mile of the south bank of Poquoson River, a small tributary of Chesapeake Bay south of the mouth of York River. The portion to the right, east of Bennett Creek, is marsh land; that to the left is partly cultivated and partly wooded. In the marsh land may be seen dark-colored areas covered with vegetable growth, light-colored wet places, many minute meandering streams bordered by mud flats covered with water at times of high tide, and several unknown objects. At the left are relatively dark-colored areas of woodland and light-colored roads leading to cultivated fields near the shore. Houses and barns appear as minute dots. The low bluffs along streams appear as sharp lines bordered by a narrow belt of sand or mud exposed at low tide. The sandy beach appears white; the mud darker.

Observations of Subaqueous Bars and Terraces

It is well known that where the water is clear objects submerged to a considerable depth may be seen from points far above the surface. During the war submarines were detected and followed by observers in airplanes, and sunken vessels have been located by aerial observation. It is said that objects in clear water at depths of 45 feet have been successfully photographed and that with the proper plates and ray filters the presence of objects invisible to the eye is revealed by the camera. It is possible to use this method of observation to some extent in detecting and mapping sand bars, shoals, drowned terraces, and channels.

Among aerial photographs taken near Langley Field, Va., several prints were found on which a dark belt appeared near the middle of a stream and lighter-colored belts between it and the stream banks. On comparing the photographs with charts of the areas represented it was found that the dark belts represent deep channels, and the light lateral belts less deeply submerged shoals.

The practical use of such a photograph is illustrated in Figure 8. The inner channel of Bennett Creek, ranging in depth from 9 to 22 feet, is used as a passageway for boats. In the photograph this channel appears distinctly set off from the less deeply submerged shelves on either side. The photograph used in Figure 9 also shows the navigable inner channel.

Some of the photographs, taken along the banks of the larger streams, show sand bars and other details of the bottom in a definite zone, beyond which the area appears characterless. Comparison of these photographs with the Coast Survey charts indicates that beyond a shallow submerged shelf there is a relatively sharp descent to deeper water. This is illustrated in Figure 8, where the outer edge of the zone of sand bars—the light-colored portions of wavy appearance just offshore—marks the outer edge of a shelf which is 3 to 5 feet below water level at low tide. In Bennett Creek, toward the left, this sand is sharply cut by the inner channel. It may be noticed that this central portion appears characterless, doubtless because under the conditions prevailing at the time the photograph was taken the lens was not able to penetrate this depth of water. At the right, however, where soundings indicate a depth of 8 feet of water, certain differences in color suggest unevenness of bottom.

The details of the sand-bar zone are worthy of special note. This area is at the mouth of Poquoson River, where the currents are longshore. These currents carry the sand and heap it up in spits and hooks, which point upstream. The open bay is toward the right, and each mass of sand tends to face toward the left, or upstream, producing a steplike aspect.

But not all the photographs showing coast lines reveal these subaqueous features. Evidently some conditions of atmosphere or water are unfavorable for photographing them. Unfortunately I was not able to ascertain the conditions under which the photographs of these submarine areas were taken. Many of those examined at Langley Field resulted from random shots made by students during practice flights, when no record of altitude or conditions of light, wind, or time of day was obtained. Furthermore, these pictures were taken for the purpose of photographing subaerial rather than submarine objects.

The Photographing of Underwater Features

As relatively little is known of the conditions favorable for photographing underwater objects, a record of certain flights on which such photographs were taken may be useful for future reference. A flight for observation was made with Captain Lawson on May 21, 1920, between 2 P. M. and 3 P. M. Over Langley field we circled to an altitude of 4,000 feet, then flew in a general northerly direction across the mouth of York River, turned eastward around Mobjack Bay to New Point Comfort, and returned over the water to the coast south of the York. Thence we followed a winding course southward over to the mouth of Back River and finally returned to Langley Field. The wind was blowing from the west with sufficient force to produce numerous whitecaps on the bay. The sky was somewhat evenly but thinly overcast, so that the light was fairly strong, but no direct rays from the sun penetrated the clouds.

Under these conditions of light, altitude, and surface of water the following observations were recorded. Over a broad zone near shore, in some places a mile or more in width, submerged objects were seen almost as plainly as objects above water. The white sand bars were particularly conspicuous. In several places three to seven of them were observed in parallel or concentric arrangement like giant ripples. Areas of dark mud and of green vegetation-covered bottom contrasted sharply with the sandy areas. Some of the dark places seemed to indicate deep water, but this appearance may have been deceptive. The roughness of the water surface, even where whitecaps were numerous, did not interfere seriously with visibility.

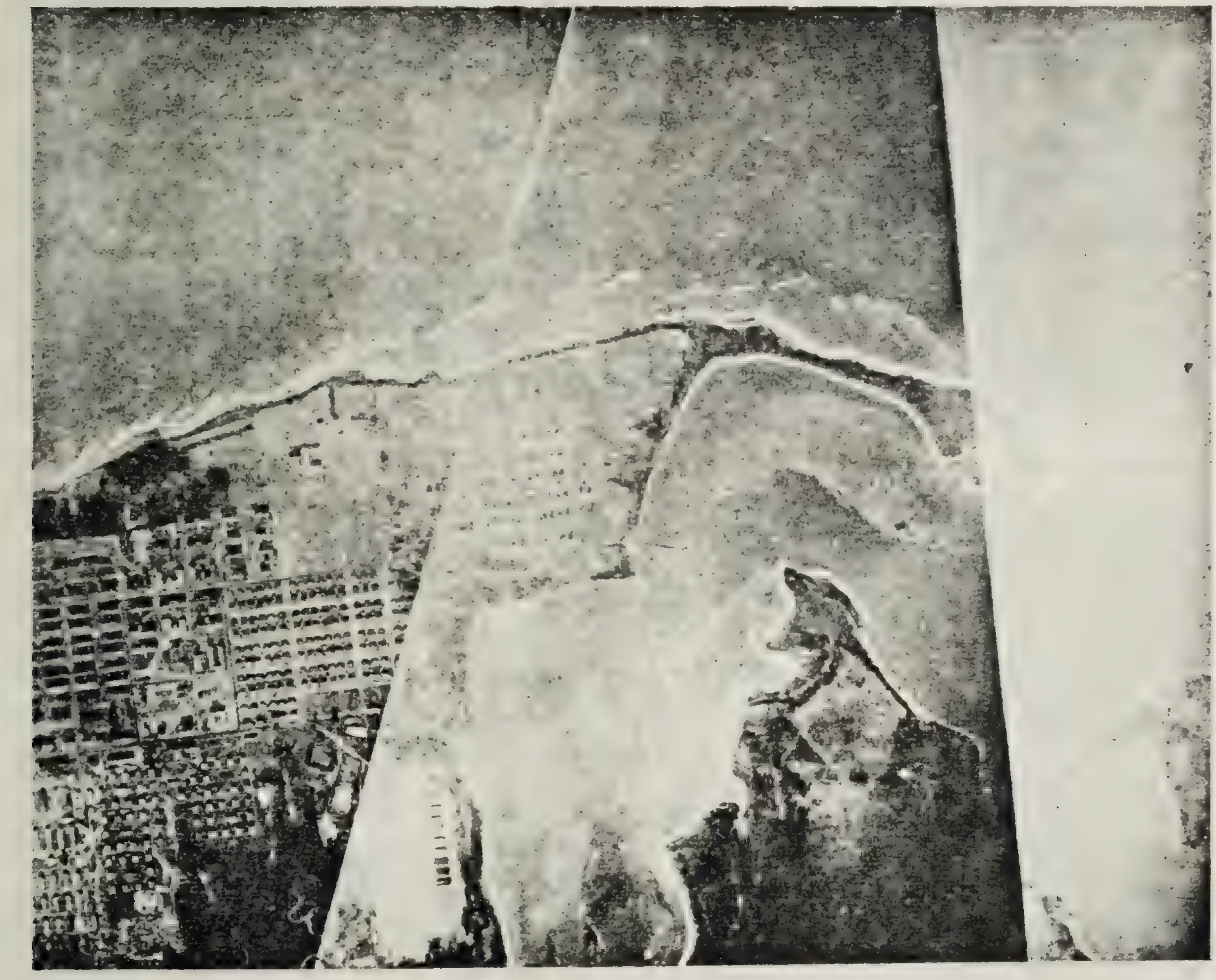


FIG. 9—Vertical view of Penniman and King's Creek, a southern tributary of York River, Va., showing navigable inner channel at the edge of which is the boat landing, marginal shoals, and sandy beach. The straight diagonal lines are due to the joining of photographic prints. (Photograph by U. S. Army Air Service.)

The submerged land forms appeared especially conspicuous in Back River, one of the so-called rivers tributary to Chesapeake Bay which are in fact estuaries where the waters of the bay occupy drowned valleys. For 3 miles or more above its mouth Back River is more than a mile wide and less than 6 feet deep, except near the middle, where a relatively narrow channel ranges in depth from 6 to 25 feet. The sinuous course of this channel is plainly discernible from the air. The outer edge of the slightly submerged shelf appears as a definite line, owing to change in slope of bottom. The boat landing at Amory's Wharf is built where the bottom descends steeply from the submerged shelf to the deep channel.

In many places on this and other estuaries the zone in which the details of bottom were clearly visible terminates at what appeared from our exalted point of observation to be a sharply defined and gently sinuous line. Most of the boat landings are at or near this line, and several beacons were seen near it. Comparison with the Coast Survey charts indicates that at the outer edge of this zone the water at low tide is about 5 feet deep. The line seemed to indicate the presence of a bench with steep outer slope, rather than a uniform slope of bottom.

In nearly all places beyond the shallow water there appeared a zone of variable width which was of a dark chocolate-brown color, darker than that near shore, but few details of the bottom could be distinguished. There are numerous fish traps and nets in this zone, many more than were observed in the shallower water. At the mouth of York River and at several places in Mobjack Bay the chocolate-colored zone terminated at a dim but plainly discernible line, beyond which the water appeared dark and characterless. Near its outer edge are the larger lighthouses such as the one at the mouth of York River off Godwin Island and those off Tow Steak Point and Wares Neck Point. The landing at Bay Side Wharf, north of New Point Comfort, is also near the outer edge of this zone. Reference to the charts indicates that the water at this landing is 12 feet or more in depth and that the lighthouses are at the outer edge of a shelf where the water is 10 or 12 feet deep. Beyond this shelf the bottom falls away sharply to deep water. It may therefore be inferred that the dark-colored characterless area near the mouth of the York River represents the deep inner channel, where the water is 25 to 70 feet deep. It may further be inferred that the dim line between the chocolate-colored zone and the dark inner channel denotes the relatively sharp descent of the bottom at the edge of a submerged shelf. These inferences, however, must be regarded as tentative and should be verified by further observations.

In studying the underwater features as shown in photographs caution and careful checking in every way possible are necessary. Changes in hue in the photograph might be due to sediment in suspension rather than to differences in depth of water. This was made obvious by the flights over the Potomac River referred to below.

Observations on the Potomac River

As the observations near Langley Field proved that shoals and channels can be photographed from the air, it seemed possible that drowned terraces and valleys such as those of Potomac River might be successfully shown in this way. To test this possibility several flights were made from Washington, D. C. Here the conditions were found to be quite different from those

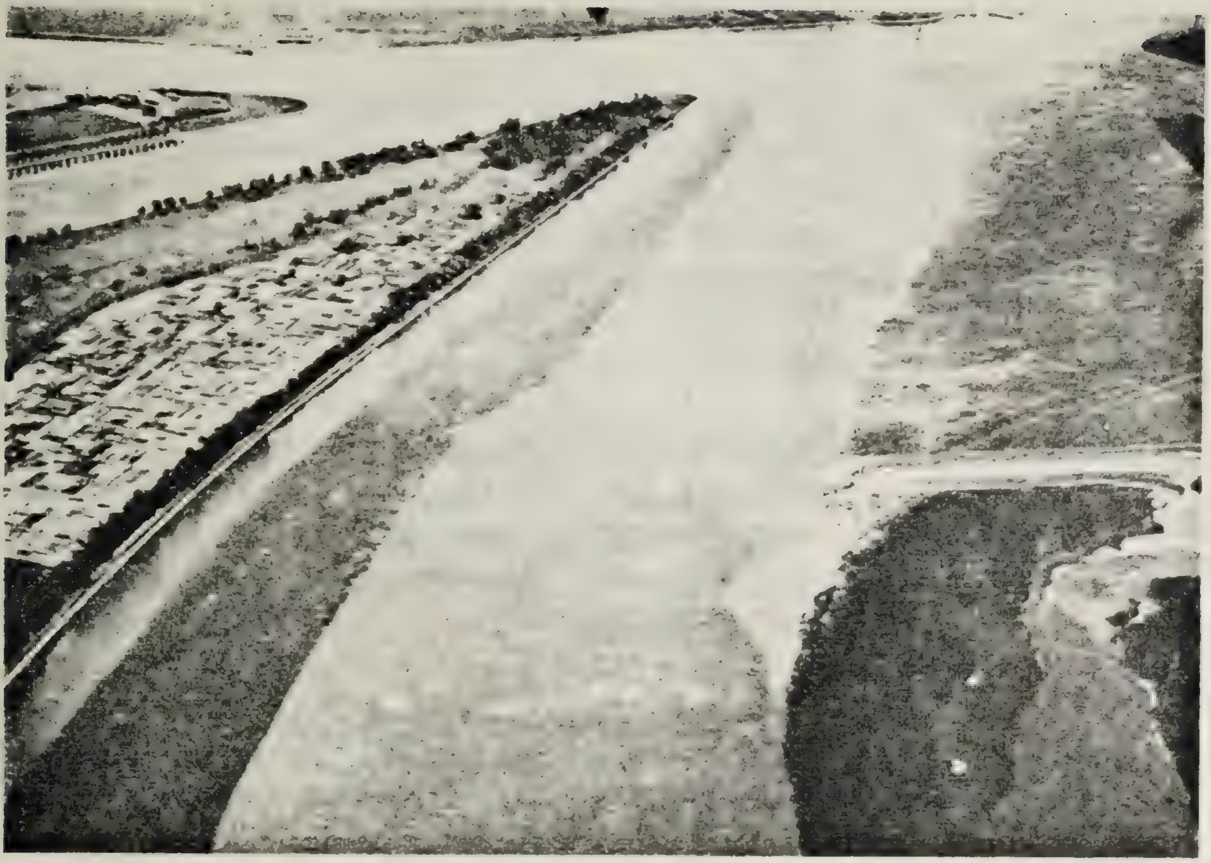


FIG. 10

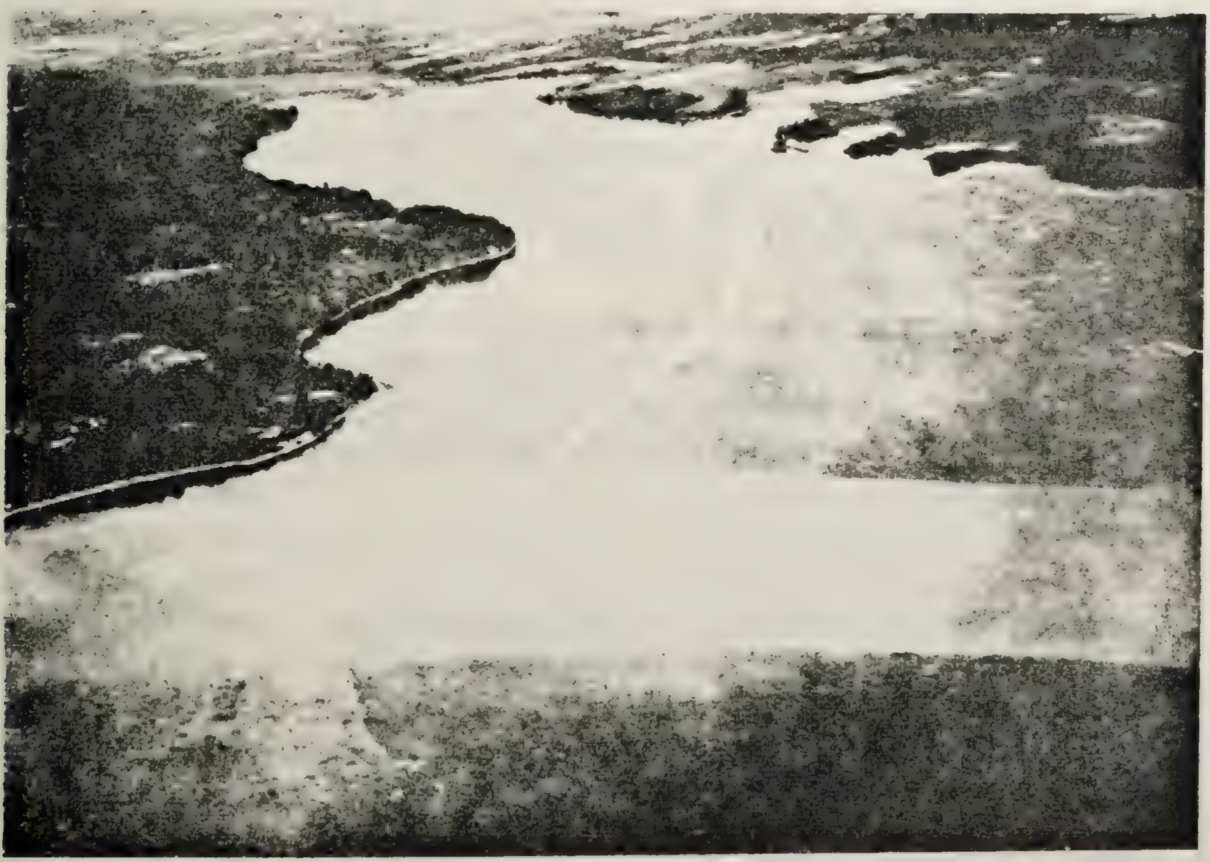


FIG. 11

FIG. 10—Potomac River and the lower end of Potomac Park at Washington, D. C., showing in the foreground the deep channel, light because of muddy water; the submerged shoal, with dark, weedy bottom showing through 2 to 5 feet of clear water; and a narrow channel 8 to 10 feet deep along the wall of the Park. The Anacostia River and Hydroplane Station appear in the distance. (Photograph by the author.)

FIG. 11—Underwater channels and shoals in Potomac River and Piscataway Creek. The channels appear light-colored because filled with muddy water. The dark shoals show through the clear water which is 2 to 5 feet deep. (Photograph by the author.)

on Chesapeake Bay. In the clear water of the bay dark color indicates depth, but in the river the deep water of the main channel was turbid and appeared light-colored (Fig. 10), while the shallow water on the broad drowned terrace was clear and appeared dark-colored because of weeds growing on the bottom. The inner channel of each tributary stream was also seen plainly (Fig. 11). Most of the tributaries entering from the hills to the west contained light-colored turbid storm water which followed the drowned channel through the clear shallow water on the dark-colored shelf to the main channel of the river. On the opposite side, where the tributaries are short and drain low land few of them contained turbid storm water. The deep inner channels here appeared darker than the drowned terrace in which they are cut. Every channel on either side was sufficiently clear to be successfully photographed. A channel filled with clear water appears in the photographic print as a dark belt; a channel filled with opaque muddy water appears light-colored. However, this light-colored portion indicates only the approximate position of the channel, because the muddy water gradually mingles with the quiet shallow water on the shelf.

Aerial Photography As an Aid to Physiographic Interpretation

The possibility of recognizing shoals and channels from a photographic print and of determining in some measure the shape of submerged land forms opens a new avenue of approach to the study of submarine geography. In some places, especially in a drowned region, aerial photography may be used with success in working out the physiographic processes that have produced the drowned land forms and thus assist in solving some vexed questions in earth history.

There is also a practical aspect of the subject, for photographic representations of shoals and channels can be used in making navigation charts and in keeping up-to-date charts of areas that undergo changes. With a photograph such as that of King's Creek (Fig. 9), a boatman should have no difficulty in avoiding shallow water. Many of the tributary channels of the Potomac and other rivers of the Coastal Plain are not charted, and some have changed since charts of them were made. Small craft on the Potomac frequently go aground where the water was supposed to be deep enough to float them. Aerial photographs showing the position of the channel in critical places might be of use.

So far as I have been able to ascertain little is definitely known of the conditions most favorable for obtaining photographs of submarine objects. It is annoyingly obvious to the aerial observer that at certain times he can see nothing beneath the surface, though at other times he can see underwater objects with great distinctness. In trying to ascertain the most favorable conditions for such observations, it was found that these objects are seen plainly when the sky is evenly overcast or when it is uniformly clear. Sometimes when the sky is only partly cloudy the surface of the water seems to act as a mirror, and nothing is seen but reflection of cloud and sky. Waves seem to have little effect on the visibility of objects beneath them except to diffuse the reflected sunlight. This reflected light is stronger than that coming from submerged objects and destroys the effect of those objects on the photographic plate. Hence to photograph underwater features successfully a time should be chosen when direct reflection of light from the sun or from a brightly illuminated cloud will not enter the lens.

Both experience in the air and experiments in the laboratory show that the best results are likely to be obtained early in the morning or late in the afternoon, under an evenly illuminated sky. But experience also indicates that there are unknown factors which affect the results. It is a puzzling fact that the photographs taken at some moments when the eye caught the image of submerged objects show only the surface of the water.

There is need of careful research to determine the conditions under which the best results may be obtained. The height and the time of day for exposure with a certain lens, the emulsion and kind of ray filter best suited under certain conditions, the effect of refraction of light as it enters and emerges from the water, and the effect of polarization are subjects demanding serious consideration.

A METHOD OF AEROPHOTOGRAPHIC MAPPING*

By Fred H. Moffit
United States Geological Survey

This paper is not intended to be the description of a finished piece of work but rather is a report of progress in the development of a method of mapping which is only in a formative stage. It will not do therefore to expect that details will be given with the greatest accuracy and that all the problems connected with the work have been solved, although the general principles on which the method is based are fully established. We believe that the direction for progress has been pointed out but that many steps remain to be taken.

The work to be described is the outgrowth of experience in using the panoramic camera for topographic mapping in Alaska during the last eight years. The panoramic camera was first used in the Alaskan work of the Geological Survey by C. W. Wright in 1904, but it was not till after Wright had left the Survey and the work he began was taken over by Mr. J. W. Bagley, now Major Bagley, that the panoramic camera became one of the instruments regularly used for topographic mapping in Alaska.[1] The opportunity to take up and carry on this method was due primarily to Mr. A. H. Brooks, now Lieutenant Colonel Brooks, Chief of the Alaskan Division.

With the outbreak of the war in Europe and the rapid development of the airplane for military purposes the camera immediately took an important place as a means for gathering military information, including the making of maps. Major Bagley turned his attention to this broader field for the camera and asked the writer, who had had some small part in the previous work, to assist him. As progress was made it was found that more assistance was needed, particularly in photography, but also in many other ways, and Mr. J. B. Mertie was invited to contribute the benefit of his experience.

These investigations, which at first were carried on under the direction of the Council of National Defense and Mr. Brooks of the Alaskan Division of the Geological Survey, were later taken in charge by the Corps of Engineers of the Army and Lieutenant Colonel Marshall of the Topographic Branch of the Survey where they have remained to the present time. Money for the first experiments was furnished by the Council of National Defense, but the large sum needed for the construction of airplane cameras and transforming cameras was allotted by the Engineer Corps.

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*This paper (published with the permission of the Director of the United States Geological Survey) was read at the meeting of the Association of American Geographers at Baltimore in December, 1918. The writer takes this opportunity to express to Lieutenant Colonel Marshall, under whose immediate direction he has worked during the last year, his appreciation of the enthusiasm and generous encouragement given Major Bagley and himself.

[1] J. W. Bagley: The Use of the Panoramic Camera in Topographic Surveying, *U. S. Geol. Survey Bull. 657*, Washington, D. C., 1917.

Principle and Problems of Airplane Mapping

The fundamental principle on which these investigations is based was first expressed, so far as the writer knows, by Theodor Scheimpflug, an Austrian army engineer, who gave many years of his life to the study of the problem. He, however, lived before the days of the airplane, so that his methods did not meet with the full success they deserved and he died without seeing any extensive application of them.

If a camera is carried above a horizontal plain and an exposure is made with the sensitive plate parallel to the plain, the resulting picture is a map whose scale is dependent on the focal length of the taking lens and the height of the camera above the plain. We apparently have at hand, then, a simpler way for making maps of many regions than the way ordinarily employed, for the airplane makes it possible to pass back and forth over a chosen area at will. Yet two difficulties are met when airplane photographs are employed in making maps. First, it is impracticable if not impossible with any means yet devised to keep the camera in a horizontal position; second, the angle of view of the fast lenses which must be employed in taking photographs from airplanes is small, so that the area covered at each exposure is also small and a great number of pictures must be taken in constructing the map. These, then, are the first problems that must be taken up if an accurate map is to be made at less expense than by the usual surveying methods.

The investigation to be described falls naturally into two divisions, of which the first deals with the airplane camera, that is with photographing the terrain. To this Major Bagley gave his attention. The second has to do with correcting the inclined airplane pictures; and for the study of the principles involved and the design of the transforming camera the writer is responsible. The questions relating to photographic methods and the construction of charts and computing devices for use with the transforming camera fell to Mr. Mertie.

The Airplane Camera

The difficulty of obtaining a lens which shall have speed and at the same time a wide angle of view is met by constructing a multiple camera with its three lenses and focal planes so arranged that the central plane shall be in a horizontal position and the other two shall be inclined at a fixed angle to it. The side pictures, because of their inclination, include areas outside the field of the central picture but overlap it slightly so as to give the means for joining them. A photograph of such a camera is shown in Figure 1.

The camera is about 25 inches high, 22 inches wide, and 7 inches thick from front to back. It consists of two parts, which may be separated from each other. The upper part is the magazine which carries the roll film. The lower part is really three distinct camera boxes, each fitted with its own lens and shutter, joined together.

The two side focal planes of the camera are inclined to the central plane at an angle of 35 degrees, and as a consequence the angle between the axes of the two side lenses and the central lens is the same. Lenses of about 7-inch focal length are used on the two side boxes and one of about 6 inches on the central box. The automatic shutters (Fig. 2) are released by a special cable release which acts on the triggers of the shutters through a synchronizing device shown in the photograph. This release is so adjusted that the shutters open and close at exactly the same instant. It is necessary that the time of exposure shall be as short as possible in order that a sharp image may be obtained. This necessity is the result of several causes, chief of which are the vibration of the engine and the angular movement or roll of the plane.

When a film is to be inserted in the camera the magazine is lifted off the boxes, the unexposed spool is placed in position in its supports near the center of the magazine, and the free end is attached to the winding spool in the top of the magazine. After being replaced the magazine is made fast to the lower part by thumbscrews which bring the two sides closely together and prevent the entrance of light.

The film is wound off by hand by the crank seen in the illustration (Fig. 3). A registering device shows the length of film turned off when the crank is turned, and a marking device makes a mark on the film whenever the release is operated, so that the film may be cut without spoiling a negative. The film is 5 inches wide and has a maximum length of about 400 feet. The individual negatives are 5 inches wide and 6 inches long.

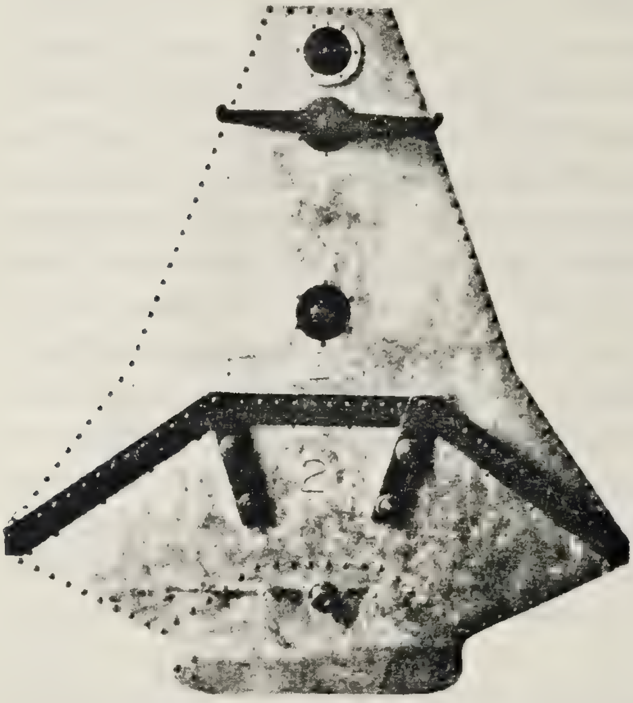

FIG. 1—Front view of the airplane camera showing the crank for winding the film and the index of the film measuring device.

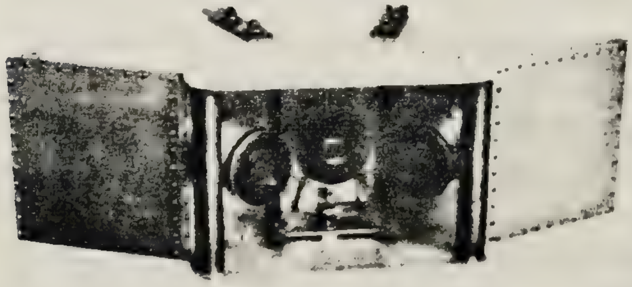

FIG. 2—The bottom of the airplane camera showing the lenses and the synchronizing advice.

To mount the camera in the airplane a hole is cut in the bottom of the fuselage in front of the observer's seat, and a cradle, closed below by a sliding door for the protection of the lenses, is fastened securely to the floor. This cradle is padded with felt or sponge rubber, and the camera is strapped securely in it. Some airplane cameras are mounted on gimbal rings whose movement is damped by a dashpot arrangement. Such a mounting has been constructed for this camera but has not yet been tried out. It is not expected that this mounting will keep the camera in its proper position, for seemingly no device dependent on gravity alone for its effect has been able to do this fully. Probably it can do no more than reduce the errors of deviation.

MAKING THE EXPOSURES

The frequency with which exposures are made at a given altitude in getting pictures with proper overlap depends on the rate of movement of the plane over the ground, which in turn is dependent (1) on the airplane itself and (2) on the movement of the surrounding air; for the speed of the plane referred to the ground may be greatly increased or retarded as the plane flies with or against the wind. The time interval between exposures varies roughly from one-quarter minute to one minute. The observer making the exposures, however, does not rely on a time interval for getting properly spaced pictures but is chiefly dependent on a large negative lens about 6 inches square which is set in the bottom of the fuselage and enables him, as he views objects below him, to judge both the direction and the rate of movement over the terrain.

This camera still lacks one essential feature necessary to make it fill its purpose fully. It should have incorporated in it a device for recording on the film at the time of exposure the amount and the direction of the tilt of the central plate, for, as has been stated, it is not yet possible to keep the camera in a horizontal position. Correction of this fault appears to be only a matter of adapting to the camera some such principle as that of the gyroscope on which others have been at work and which seems now to be brought to a condition for practical application in this place.[2]

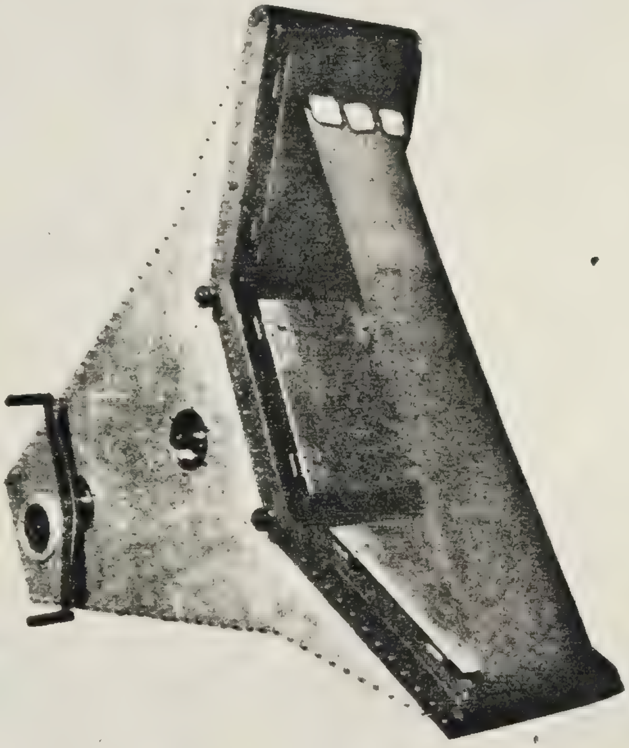

FIG. 3—The top of the airplane camera showing a film being inserted and the aluminum plates which indicate the position of the focal planes.

The Transforming Camera

Pictures taken with the airplane camera just described are subject to errors arising from the construction of the camera itself and from the tilt of the airplane, for it is only when the plate is taken in a horizontal position that the resulting picture is a map. These errors may be corrected graphically by projecting chosen points one by one on a plane representing the plane of the horizon, but the process is long and tedious. It was for the purpose of making these projections photographically that the transforming camera was designed.

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[2] Since this paper was written Lieutenant W. A. Hyde, of the Science and Research Division of the Air Service, and the writer have constructed a pendulous camera whose motions are damped by a gyroscope and have obtained encouraging results. This investigation is still in progress.

PRINCIPLES OF CONSTRUCTION

Before describing the working of the transforming camera it is desirable to state two principles on which the construction of the instrument is based.

Let $A\ P_1$ and $A\ P_2$ (Fig. 4) be two planes intersecting in the line A, and through any point O pass planes C_2O and C_1O parallel to planes $A\ P_1$ and $A\ P_2$ respectively. Project point a through point O onto the plane $A\ P_2$ in a'.

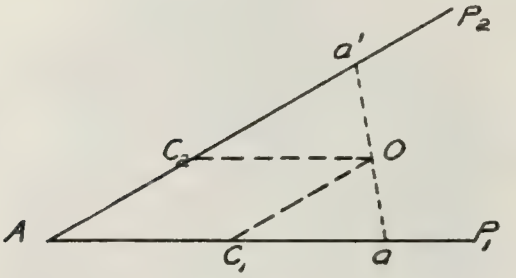

FIG. 4 (a)

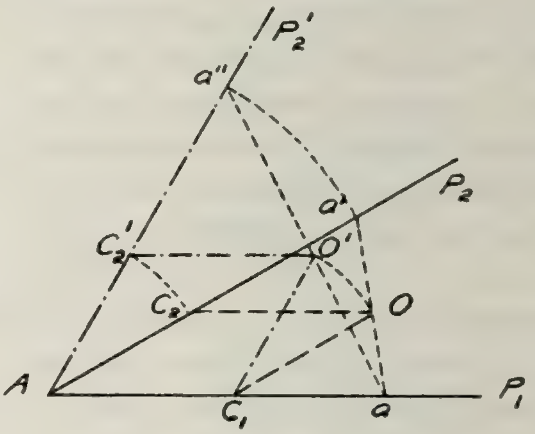

FIG 4 (b)

Now if we revolve the plane $A\ P_2$ about line A, the point a' is revolved to a'', the point C_2 to C'_2, and O to O'; and it may be demonstrated that the points a, O', and a'' lie in the same straight line, that is O' remains the center of projection for point a and its projection a'' on the revolved plane $A\ P'_2$.

This principle has an important use in the construction of the transforming camera. The second principle deals with lenses.

Let O (Fig. 5) be a lens of focal length f, whose axis is perpendicular to the plane passing through the optical center of the lens and the intersection of two planes $A\ P_1$ and $A\ P_2$. Further let O be so situated that it lies on the line which joins a, the intersection of $A\ P_1$ with a plane whose distance from O is twice the focal length, to b, the intersection of $A\ P_2$ with a plane whose distance from O is also equal to twice the focal distance.

These conditions may be expressed in a slightly different way, thus: Let the plane of the lens O pass through the intersection of the planes $A\ P_1$ and $A\ P_2$, and let O lie in the intersection of two planes C_1O and C_2O, which are parallel respectively to $A\ P_2$ and $A\ P_1$ and pass through the intersections of planes $A\ P_1$ and $A\ P_2$ with the focal planes of the camera.

If these two conditions are satisfied it may be proved that all points on either plane $A\ P_1$ or $A\ P_2$ are sharply in focus on the other plane.

This fact is the second principle which we need to use. Let us now see how these principles are applied to the correction of pictures taken in an inclined position.

Let P_2 (Fig. 6 a) be a negative on which are photographed the points A, B, and C. Let f be the focal length of the lens, i the angle of inclination of the plate, and D the height of the camera above the ground. The points a, b, and c are images of A, B, and C. Now the size of the image a, b, c, with any given inclination i, depends on the focal length of the lens and the height of the camera above the ground. This inclined photograph does not show a, b, and c in their true relative positions, but it can be made to do so by projecting the image onto some plane parallel to $A\ B$, such as P_1; and the scale of the resulting image depends on h, the distance of the plane P_1 from O. In order to show how this projection may be made photographically, produce the planes P_1 and P_2 till they intersect in A (Fig. 6 b), and draw C_2O and C_1O through O parallel to $A\ P_1$ and $A\ P_2$. Also replace the lens of the taking camera by another lens whose focal length is f_3, the length of the perpendicular let fall from either C_1 or C_2 to $A\ O$. It should be noted that $A\ O$ is the plane of the new lens. We have now fulfilled the conditions that must be fulfilled if we are to obtain sharp images of the points a, b, and c on the plane P; but we have limited ourselves to the use of one lens in making any given projection and shall require a different lens for every different angle of inclination. If, however, we revolve plane P_2 about the axis A we may vary the distance f_3 and thus, within certain limits, adapt our figure to whatever lens we find it convenient to use in the transforming camera. In the description so far the separation of the principal points of the lens has been disregarded. This was done to simplify the description and is entirely proper, for the same conclusions would have been reached had this been taken into consideration.

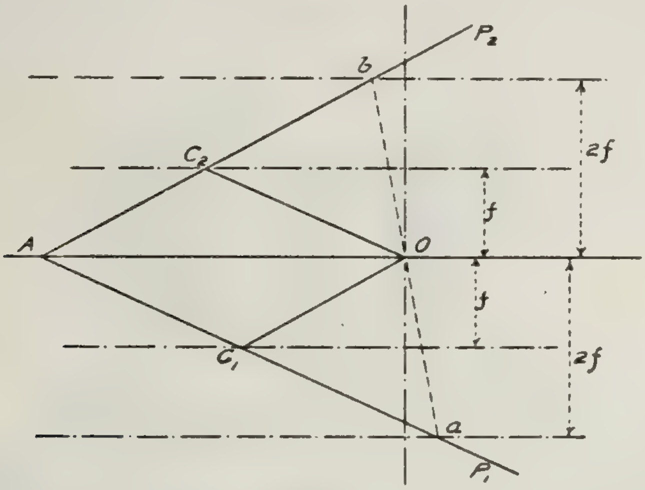

FIG. 5

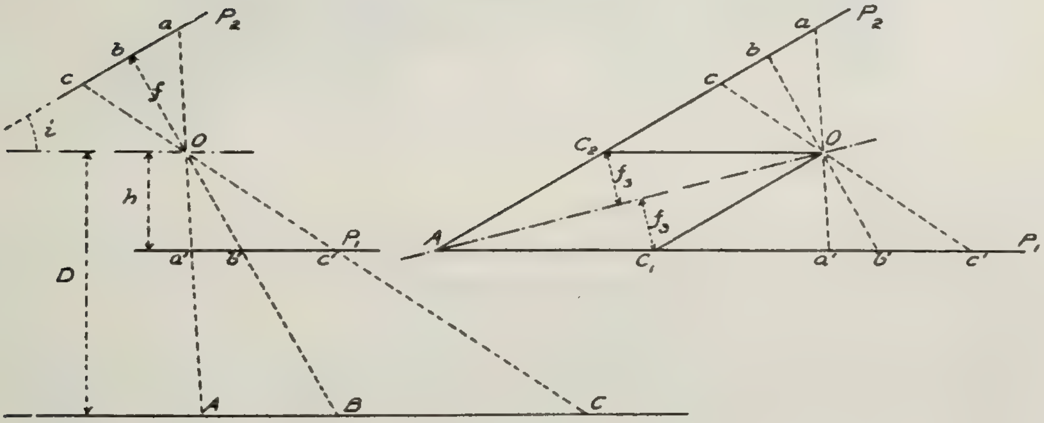

FIG. 6 (a)

FIG. 6 (b)

FORM OF CAMERA

The simplest form of transforming camera capable of transforming photographs taken at different angles of inclination is one in which the two sides are hinged together and have their line of intersection in the plane of the lens. Such a camera is impracticable if the angle of inclination is small or has a wide range of values. The form of camera we have been using is shown in Figure 7. The two sides instead of being hinged together are made to revolve about vertical axes, and they together with the lens are capable of movements that permit all the conditions indicated in the previous diagram to be satisfied. The vertical axes may be moved to and from the lens, and in addition one axis and the lens may be moved transversely. The two axes are so connected with the frame supporting the lens that they and the lens are always in line. The large disks supporting the negative and the sensitive plate may be moved horizontally in their own planes.

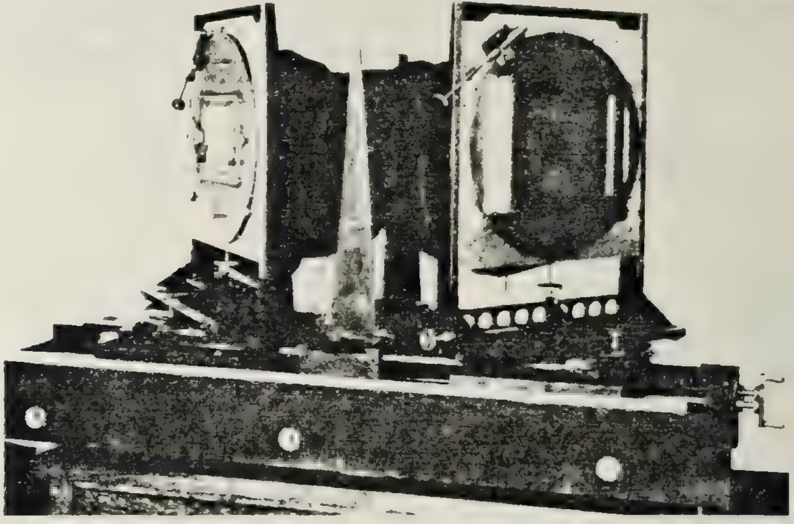

Fig. 7—The transforming camera. The sides are inclined toward each other showing the revolving disks on which the negative and the plate holder are carried.

The transforming camera is an instrument for doing accurate work. It is necessary that the films or plates be put exactly in their proper positions and that the settings of the scales be correct.

In setting up the transforming camera it is assumed that the focal lengths of all lenses employed, both in the airplane camera and in the transforming camera, are known and that the inclination of the picture to the horizon plane is known or can be found. With these data the setting of the instrument can be made after certain simple trigonometric calculations are completed, or the setting may be taken from charts constructed for the purpose. The charts are graphical representations of the trigonometric formulae and simplify greatly the work of making transformations. The camera is provided with scales and verniers so that the settings may be made with the required accuracy. It is not necessary to give here the formulae for obtaining the settings, but it should be said that it is nearly always best to have the solutions represented graphically.

Transformation of Photographs

The inclined airplane photograph shows distant objects on a smaller scale than the near objects, so that the problem of the transformer is to restore a uniform scale to the picture by enlarging or reducing some part of it. Ordinarily one part of the photograph is enlarged, another is reduced, and the two parts are separated by a line where no change has taken place. Figure 8 shows one of the side pictures before and after its transformation.

The procedure followed so far in working up the airplane photographs is first to transform the side pictures to the plane of the central picture (Fig. 9), and when necessary all three to the horizontal plane, and then by an independent operation to bring all the pictures to the required scale, which, as a rule, is much smaller than the approximately 1:10,000 scale on which the original pictures were taken. After being brought to the chosen scale the pictures are cut to fit and joined together (Fig. 10). A certain amount of independent horizontal control is needed in this method of mapping as in all others, particularly if an extensive area is to be mapped, but our experience is not yet wide enough to show just how much of such control will be required. It will of course depend in part on the scale of the map.

Difficulties in Aerophotographic Mapping

The chief sources of difficulty that arise in making maps from airplane photographs lie (1) in the lack of suitable means for obtaining the data for transforming the inclined pictures into a truly horizontal position and (2) in the errors introduced into the pictures by relief of the terrain. The first of these has already been spoken of in describing the airplane camera and will be solved by installing in the camera the means for recording on the film at the time of exposure the direction and amount of inclination of the central negative. It may be solved in another way if sufficient horizontal control is available, for three or more points on the photograph may be brought into coincidence with corresponding known points plotted on the ground glass of the transforming camera, or rather on a tracing paper which can be compared directly with the image on the ground glass, and this of itself brings the picture into the horizontal position.

Error Due to Relief of Terrain

The second source of difficulty, or that arising from relief of the terrain, becomes of greater and greater importance as the relief increases. If the scale of the map is large the error must be taken into consideration even when the relief is small. Apparently the errors of relief cannot be corrected directly by photographic means, and for the proper location of individual points it becomes necessary to determine the station point, or the point on the ground directly below the camera at the moment of exposure, and to find the position of the desired points by intersections from two photographs. This adds an extra operation to the work, which it is desirable to avoid where possible. Another line of attack on the errors brought in by relief is through the properties of stereoscopic vision. This

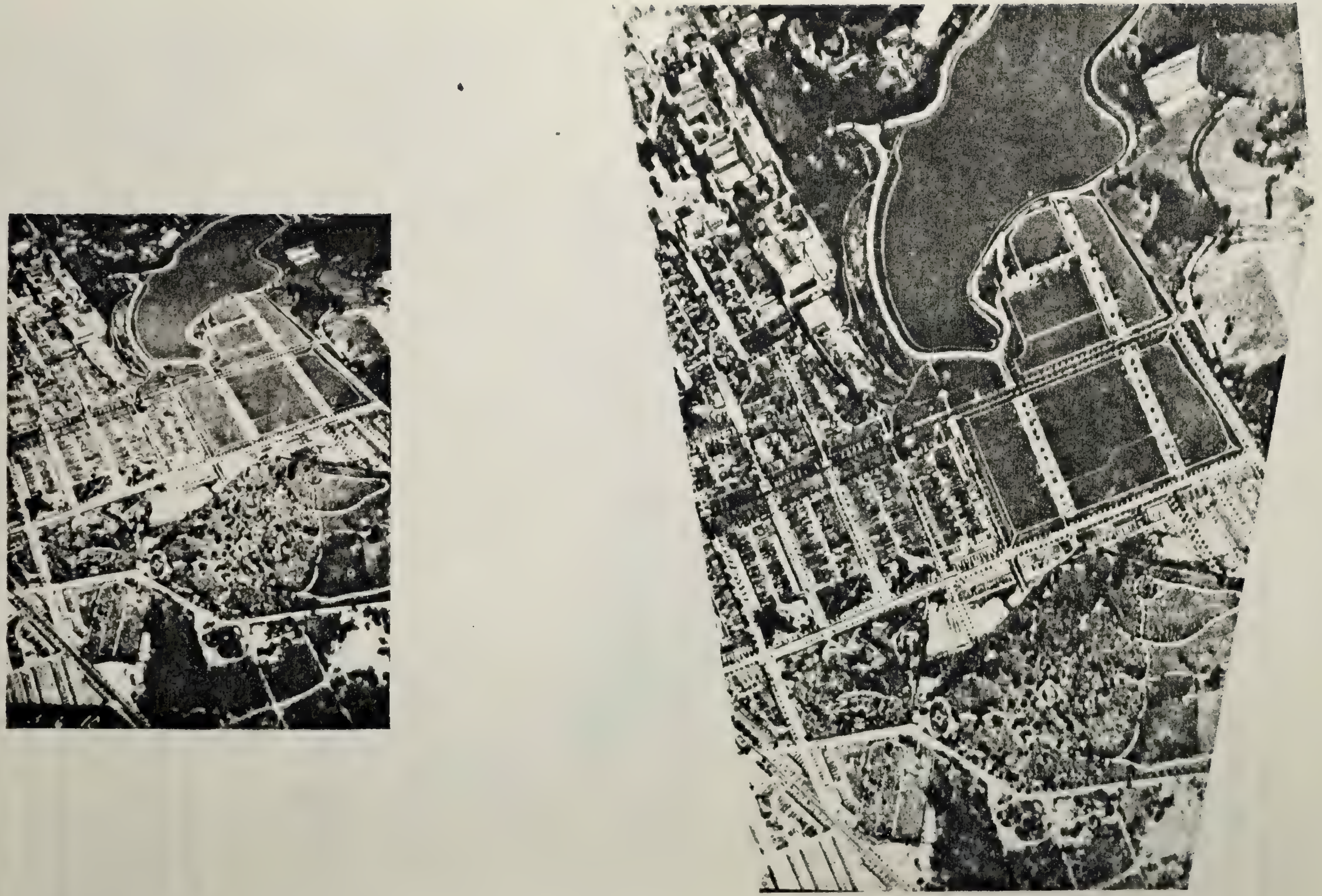

FIG. 8—On the left one of the side pictures taken with the airplane camera; on the right the same picture after it has been transformed to the plane of the horizon. About two-fifths the size of the original photographs.

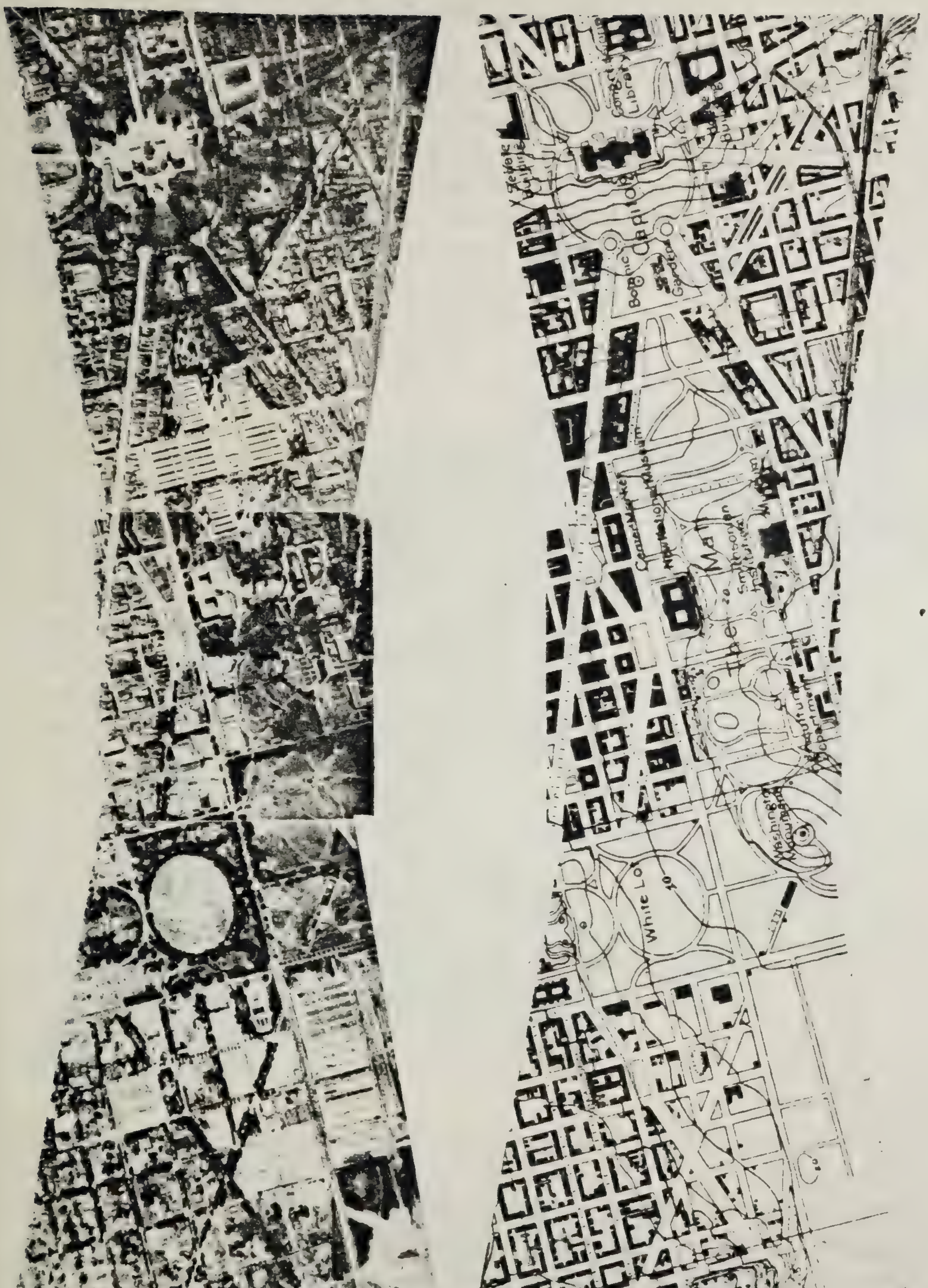

FIG. 9—A set of three pictures of a part of Washington compared with the map of the same section.

involves the use of overlapping pictures and some instrument such as the stereocomparator, constructed for accurately measuring parallax, which may be employed in correcting errors of relief and, if the necessary data are obtained, affords a refined method of drawing the contours to express the relief. This important part of the work is a feature on which we have hardly touched as yet. Fortunately a certain amount of error due to relief comes within the error allowable for the scale of the maps usually made in this country. "Mosaic" is a term commonly employed to designate most of the maps made from airplane photographs. It will be of interest to make a comparison between such maps and maps made by the method just decribed.

ADVANTAGES OF MULTIPLE AND TRANSFORMING CAMERAS

The advantages of the method under consideration may be divided into two classes, those arising from the use of the multiple camera and those due to the use of the transforming camera. It will be well to state again that there would be no advantage in the use of a multiple camera if it were possible to get well corrected fast lenses of wide angle. The chief advantage of the multiple camera over the single-lens camera is the increased field of view which makes it possible to cover a given area with fewer flights and therefore in shorter time and at less expense. The area covered by the three pictures of the three-lens camera at a given elevation is about four times the area covered by the central picture alone, and this is roughly the ratio that holds between the three-lens camera and most of the single-lens cameras. Further the three-lens camera reduces the probability of leaving parts of the terrain unphotographed and makes easier the final assembly of the pictures. A uniform overlap in the series of pictures made during successive parallel flights is difficult to maintain, so that frequently it is found either that the overlap is too great or that a part of the terrain is unphotographed. A wide field of view in the airplane camera helps to minimize this difficulty.

The advantage due to the use of the transforming camera is chiefly that it makes possible the use of pictures that without it would be unusable or greatly in error because the subject photographed was not parallel to the plate and therefore the pictures do not have a uniform scale; but no advantages arising from it are such that they may not be enjoyed in either method. It would be much more nearly correct to say that until the means is devised for keeping the camera plate in a horizontal position the transforming camera is essential to either method if accurate work is to be done. So far as the writer's knowledge goes no airplane camera has yet been constructed whose pictures are not subject in some degree to errors arising from the tilt of the plane. In practically all this, error may be and often is much greater than any allowable error.

The Possibilities of Aerophotographic Mapping

The advantages that will arise from the use of photographs taken from the airplane or dirigible airship for the making of maps can hardly be overestimated. These advantages are of many kinds and include among others greatly increased speed, greater accuracy in details, reduction in cost, and, for special purposes such as the use of aircraft pilots, the possibility of representing on the map the actual appearance of the terrain as it is seen from above. Further it will make possible the mapping of areas which for the lack of roads and other means of transportation or for other reasons are now practically inaccessible. When a strip of country from three to five or more miles wide can be photographed at the rate of seventy-five or one hundred linear miles per hour, according to the speed of the airplane, it is not difficult to see that the length of time per square mile devoted to actual field work in the older, established methods now in use must be even hundreds of times greater than in the new method.

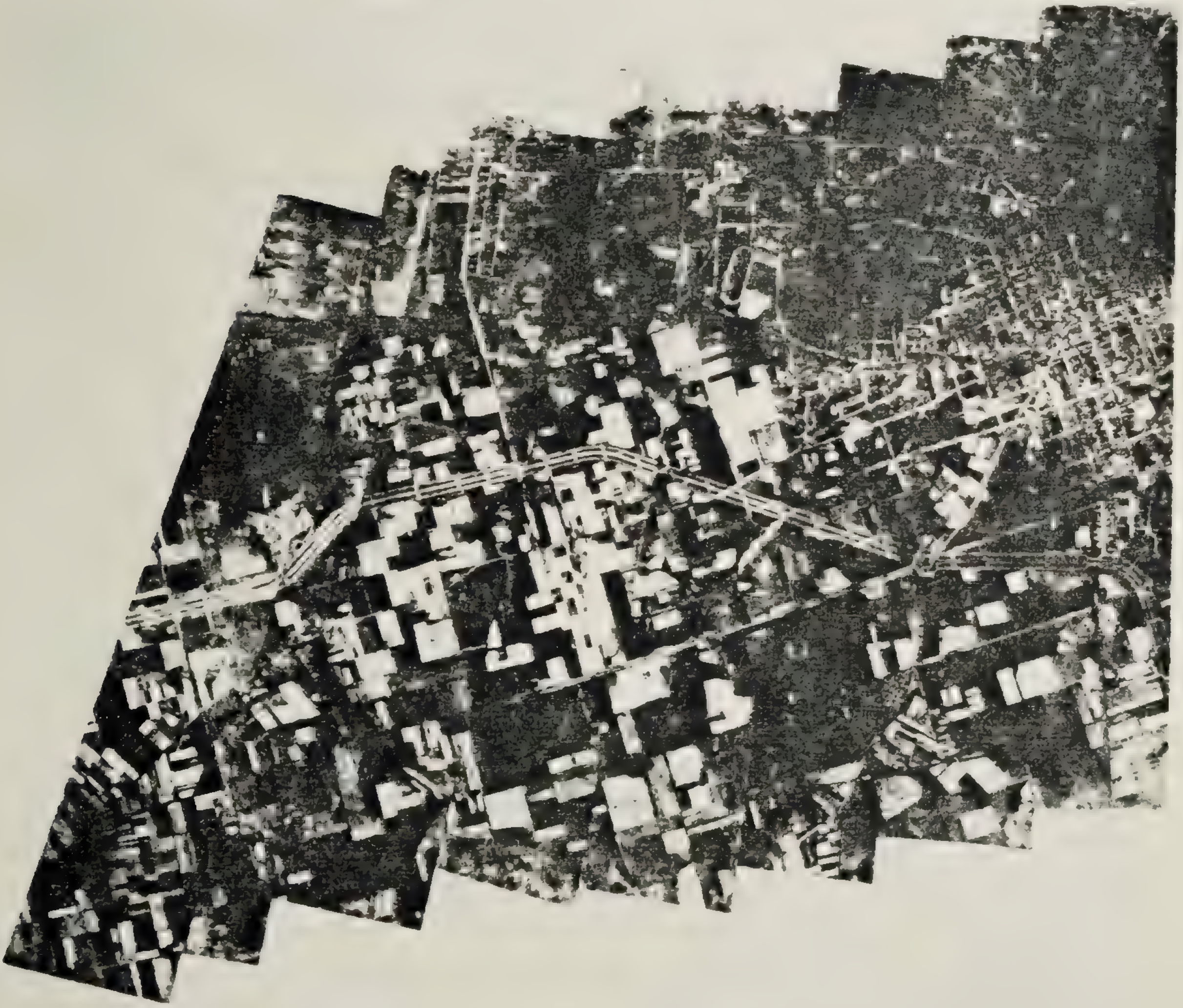

Fig. 10—A series of photographs taken with the airplane camera after they have been reduced to the horizontal plane and joined together.

The errors that arise from the relief of the terrain have been referred to and are fully appreciated, and for that reason it is believed that the first application of the method should be in areas of low relief. Many thousands of square miles of such land are still unmapped in the United States, including most of the Atlantic and Gulf Coastal Plain as well as great areas in the west. The Coastal Plain in particular is well adapted to test the merits of the photographic method of mapping, for it is a region of low relief, largely unmapped, and in many parts extremely difficult of access.[3] Another field of application in which it is believed that the photographic method will be most useful is in the revision of existing maps, as in the addition of features like new roads built since the map was made or of timbered areas not mapped originally. Only those who have had experience in the study of airplane photographs can realize fully the wealth of material they contain for the map maker.

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[3] Compare the preceding article by W. T. Lee: Airplanes and Geography, pp. 310-325.

A NEW SERIES OF SUNSHINE MAPS OF THE UNITED STATES*

By Robert DeC. Ward
Harvard University

Sunshine charts are of two classes. They either (1) give the number of hours of bright sunshine, as determined by means of sunshine recorders; or (2) they show the duration of sunshine in percentages of the possible duration. These percentages may be obtained from the cloudiness estimated by eye at regular hours, or by comparing the total number of hours of bright sunshine, as indicated by sunshine recorders, with the total possible number of hours and expressing the results as percentages. When eye observations of cloudiness are available, but sufficient instrumental records of sunshine are lacking, the former method is the one naturally adopted. Sunshine charts of both kinds have been published for the United States.[1] For publication in the forthcoming section on "Climate" in the "Atlas of American Agriculture," a new series of sunshine maps of the United States has recently been prepared by Mr. Joseph Burton Kincer, of the U. S. Weather Bureau. In view of the long delay in the issue of the "Atlas," these new maps have been given advance publication in the *Monthly Weather Review.*[2]

Each of the methods of presenting sunshine data has its advantages, and Mr. Kincer makes use of both. Charts and curves show the mean solar time of sunrise and sunset and the average length of the day (sunrise to sunset), representing the possible maximum amount of sunshine for different seasons of the year. There are charts indicating, for each month, the average amount of sunshine in hours per day; also charts and curves showing the seasonal and annual distribution in percentages of the possible amount and the percentage of days clear, partly cloudy, and cloudy. The diurnal distribution of sunshine is presented graphically. A table gives, for each month and for the year, the average percentages of the possible amount of sunshine for all stations where continuous automatic records are made. This includes practically all regular reporting stations. The basic data are for the uniform period of 20 years, 1895 to

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* This is the sixth in a series of articles by the present writer on the climatology of the United States. The previous articles were: Climatic Subdivisions of the United States, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 672–680; Rainfall Types of the United States, *Geogr. Rev.*, Vol. 4, 1917, pp. 131–144; Rainy Days and Rain Probability in the United States, Vol. 7, 1919, pp. 44–48; Frost in the United States, *Geogr. Rev.*, Vol. 7, 1919, pp. 339–344; Cloudiness in the United States, *Geogr. Rev.*, Vol. 9, 1920, pp. 347–356; New Monthly and Seasonal Rainfall Maps of the United States, *Geogr. Rev.*, Vol. 10, pp. 173–181.

[1] See R. DeC. Ward: Bibliographic Note on Sunshine in the United States, *Monthly Weather Rev.*, Vol. 47, Nov., 1919, pp. 794–795.

[2] J. B. Kincer: Sunshine in the United States, *Monthly Weather Rev.*, Vol. 48, Jan., 1920, pp. 12–17.

1914. The percentages of the possible amounts are for the eight-year period 1905-1912. Mr. Kincer's charts and text, inasmuch as they are based on data covering the same period of time, will doubtless for many years remain the standard discussion of the sunshine of the United States.

The map below (Fig. 1), redrawn, with the addition of shading, from Chart I of Mr. Kincer's paper, shows the distribution of sunshine for the year, expressed in percentages of the possible amount. The latter is essentially the same for all parts of the country, the average possible

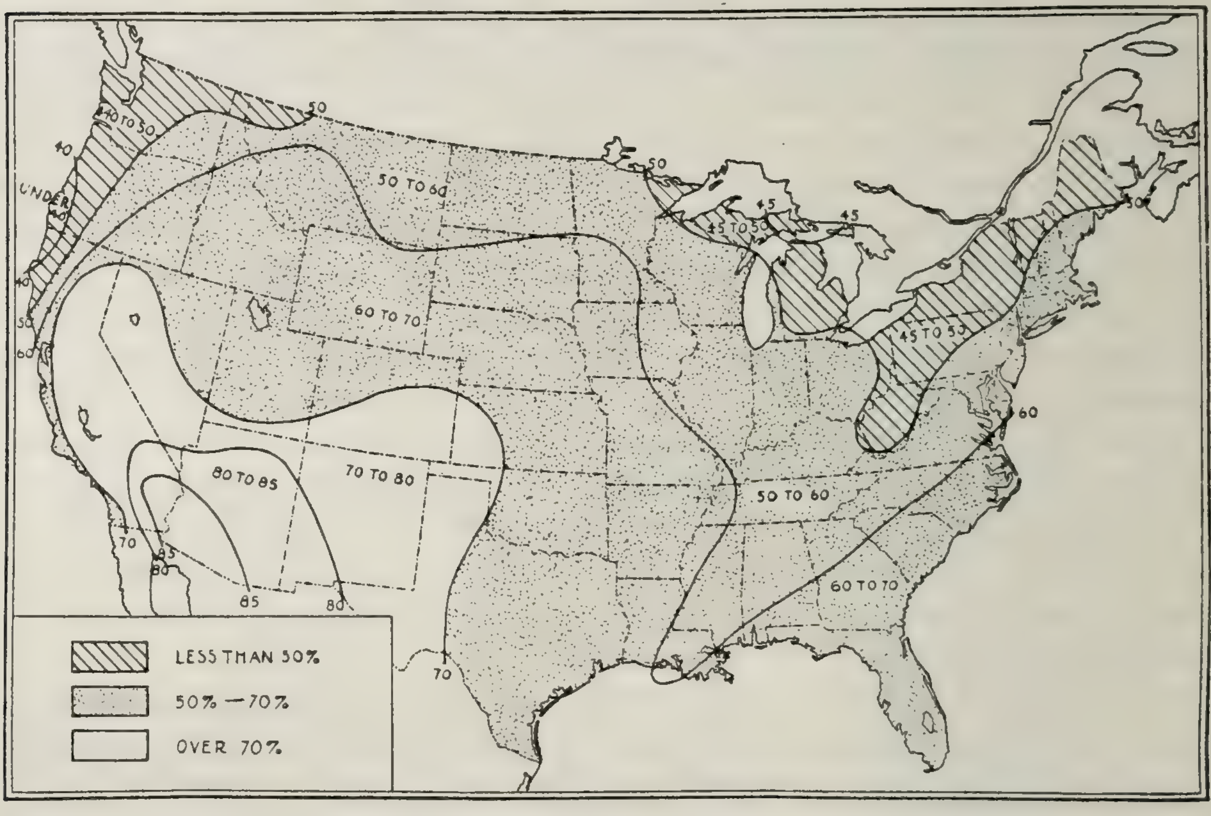

FIG. 1—Map of the United States showing mean annual sunshine expressed in percentages of the possible amount. Scale 1:45,000,000 (after J. B. Kincer).

yearly amount at latitude 25° N. being 4,437.2 hours and at latitude 49° N. 4,472.6 for a 365-day year. The maximum percentage of sunshine (over 85 per cent) is in the extreme southwestern interior. The minimum (under 40 per cent) is along the northern Pacific coast. The Lake region, the northern and central portions of the Appalachian area, and the northeast, have slightly higher percentages (45 to 50 per cent). Elsewhere east of the Mississippi River and over the northern tier of states from the Upper Great Lakes westward to the Rockies, the percentages range from 50 to 60. They are somewhat higher in the southeast, especially in the Florida peninsula. Between the Mississippi River and the Rocky Mountains the annual percentage is generally between 60 and 70, and the same values hold for the central Rocky Mountain region and northern Plateau states. There is thus seen to be a decrease in the amount of sunshine from the southwestern interior to the northwest, north, and northeast and, to a less degree, to the east. For the United States as a whole the average annual amount of sunshine is about 60 per cent of the possible amount.

The sunshine conditions for the four seasons, given in percentages of the possible, show, for the country as a whole, 48 per cent in winter, 60 per cent in spring, 68 per cent in summer, and 60 per cent in autumn. The maximum seasonal amount of sunshine is 95 per cent—in the valley of California in summer. The minimum amount is under 30 per cent—over the northwest in winter. The annual variation is greatest in the northwest and over the Great Lakes. Both of these regions have marked seasonal variations in cyclonic activity, and both have marked effects of water areas upon the moisture-content of the prevailing winds. The charts showing the average number of hours of bright sunshine daily, by months, indicate quite emphatically the general northward migration of summer conditions, with more sunshine as the season advances from the colder to the warmer months. The summer months are the sunniest in most sections, while spring and autumn have the most sunshine over certain smaller areas. July is the time of maximum sunshine over about one-half of the country. The increase in the amount of sunshine from winter to summer is very marked over the northern portion of the United States.

The annual percentages of clear, partly cloudy, and cloudy days have also been charted. The percentage of clear days ranges from about 20-25 per cent on the northern Pacific coast and over the Lake region to over 90 per cent in the extreme southwestern interior—in southeastern California and southwestern Arizona. On the other hand, the percentage of cloudy days is at a minimum (5 per cent) in the last-named district and at a maximum (over 40 per cent) in the other two areas. For the country as a whole there is less sunshine in the early morning hours; there is a secondary minimum in the late afternoon, and a maximum near noon. This general rule and the departures from it may be explained by the conditions of local cloud or fog formation.

Many interesting comparisons suggest themselves as regards sunshine between Europe and the United States. The contrast between western Europe and eastern North America was clearly emphasized by Woeikof a number of years ago.[3] He pointed out that the American coast has great advantages in respect to sunshine, especially if stations having similar temperatures and not stations in the same latitudes are considered. "Not only is the duration of sunshine longer (on the American coast) but the air is clearer, especially in the colder months. This contrast is very strikingly emphasized on the voyage from England to the United States."

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[3] A. Woeikof: Die Klimate der Erde, Jena, 1887, Part II, p. 45.

GEOGRAPHICAL RECORD

NORTH AMERICA

Swamp Lands of Georgia. In 1911 the Geological Survey of Georgia, in co-operation with the Office of Experiment Stations of the United States Department of Agriculture, published Bulletin 25, "A Preliminary Report on Drainage Reclamation in Georgia." This included an introductory chapter and a description of Okefinokee Swamp by S. W. McCallie, the state geologist, descriptions of a few particular counties and localities by the representatives of the government, and a proposed drainage law. The investigations have been continued in Bulletin 32 of the same series, published early in 1918, entitled "Agricultural Drainage in Georgia," by H[arry]. H. Barrows and J. V. Phillips of the U. S. Department of Agriculture and J. E. Brantly, assistant state geologist. It contains some interesting data about the area of swamps and other wet lands in the state, together with a discussion of methods recommended for reducing that area.

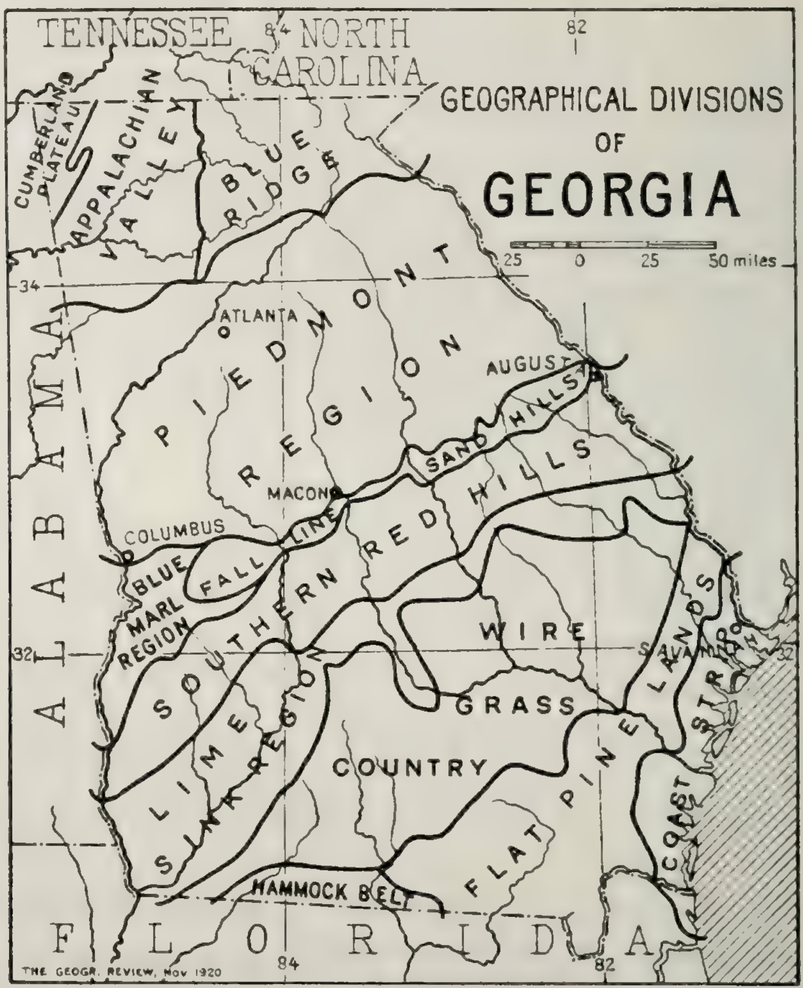

FIG. 1—Map showing the geographical divisions of Georgia. Descriptions of most of the divisions can be found in *Annals New York Acad. of Sci.*, Vol. 17, Part I, 1906, and in *Geol. Survey of Georgia, Bull. 26*, 1912. The map is simplified from one used in *School Sci. and Math.*, (Vol. 18, 1918, p. 704) and in *High School Quarterly* (Vol. 7, 1919, p. 255).

In this bulletin the physiography of the state is briefly described, with a map showing seven divisions, four above the fall line and only three in the coastal plain. The treatment of the coastal plain is decidedly inferior to that of Otto Veatch, who mapped six divisions of it a few years earlier in Bulletin 26 of the same series (reviewed in *Bull. Amer. Geogr. Soc.*, Vol. 46, 1914, pp. 920–923.) A few pages are devoted to climate, with special reference to exceptionally heavy rains that should be provided for in drainage projects, but little attention is paid to the marked differences in seasonal distribution of precipitation in different parts of the state.

Generally speaking, the amount of swamp land in Georgia increases from north to south, not only because the northern part is mountainous and maturely dissected and the southern comparatively low and flat, but also because near the coast most of the rain comes in the warmer months, thus tending to counterbalance the evaporation to a considerable extent and keep the water level uniform. In the three mountainous divisions there is practically no swamp, but in the Piedmont region there is a peculiar drainage problem which is largely a result of civilization. There are no natural ponds and few real swamps in that region, but in the many decades that the land has been cultivated a great deal of sand and silt has been washed from the hilly fields into the stream channels, partly obstructing some of the smaller ones and causing them to be flooded when heavy rains run off the denuded surfaces, with consequent damage to crops in the bottom lands. By deepening and straightening the channels the flood waters are carried off more quickly, and this has been done in the last few years in several Piedmont counties.

In the coastal plain, and especially in the lower and flatter portions thereof, conditions are quite different. On account of the sandy soil and gentle slopes and small area cultivated there is very little soil wash, but several kinds of natural swamps are common. Nearly every stream is bordered by swamp, and in flat interstream areas there are numerous shallow depressions, usually occupied by cypress pond or "bay" vegetation. Some of the swamps and ponds have moderately fertile clayey soil and have been drained for agricultural purposes, while others are so sandy that it would hardly be worth while to drain them. Near the coast the salt and brackish marshes at sea level present still other problems, which are common to almost the entire Atlantic coast of the United States.

ESTIMATED PERCENTAGES OF SWAMP LAND IN GEORGIA, BY REGIONS

REGIONS	FROM SOIL SURVEYS	FROM BULLETIN 32	
		AVERAGES	EXTREMES
Cumberland Plateau	0	4	4
Appalachian Valley	0	5	1–14
Blue Ridge	0	2	0–3
Piedmont region	5	6	1–14
Fall-line sand hills	6	8	7–10
Blue marl region	3	8	1–13
Southern red hills	7	11	4–20
Lime-sink region	7	17	8–31
Wire-grass country	7	25	4–37
Hammock belt	11	32	16–60
Flat pine lands	10	66	53–80
Coast strip	34	66	60–70
Highland average	4	5	
Coastal plain average	9	28	
State average	7	21	

About half of Bulletin 32 is a tabulation of the swamp lands, or "lands needing drainage," by counties. The wet lands are divided into several classes, such as permanent swamp, periodically overflowed land (bottoms), swampy depressions (ponds, bays, etc.), wet grazing land (low pine land mostly), land needing underdrainage, and tidal marsh; though of course all these types seldom occur in one county. The percentage of all sorts of wet land in each county is given, and by combining the figures by natural regions some interesting results are obtained. Similar data can be derived from the government soil surveys, which now cover parts of every natural region in Georgia. The figures of Bulletin 32 may be taken as maximum estimates, for they cover all sorts of low land, while those from the soil surveys are near the minimum, because many types of soil that were classed as "swamp" or "meadow" in the early reports, some fifteen years ago, are now referred to definite series and types (e. g. Myatt fine sandy loam, Ocklocknee silt loam).

The accompanying table gives the results of the computation for each of twelve regions; first the aggregate of "meadow," "swamp," and "marsh" as given in the soil surveys, then the corresponding figures from Bulletin 32, and finally the lowest and highest county percentages from the same publication, to show the range of variation within a region. The true regional averages depend on one's definition of swamp but are evidently somewhere between the figures in the first two columns.

While these figures cannot be depended upon absolutely, as already indicated, they show at a glance the increasing swampiness with decreasing altitude and relief and increasing proportion of summer rain. Similar statistics for other states, particularly neighboring ones, would doubtless illustrate the same principles. (For data on swamps for six divisions of North Carolina and nineteen of Alabama and West Florida, computed from soil surveys, see *Journ. Elisha Mitchell Sci. Soc.*, Vol. 33, p. 118; *Soil Science*, Vol. 4, 1917, pp. 105–106.)

Roland M. Harper

EUROPE

The Port of Riga. In a recent number of *Meereskunde* (No. 152, 1919) Richard Pohle sketches the growth of the town and port of Riga. Riga is described as being not a part of eastern Germany but rather an outpost of German culture. The neighboring region on the north exhibits the typical landscape of a dune country. On the south it is moorland. The Riga region is on the edge of the great forest belt of northern Russia. By its position at the head of a deep bay the city early became a central trading town. London, Flemish, Dutch, and German merchants came thither for the trade with Moscow. In 1280 Riga became a Hanseatic town and soon grew to be a factor in the commercial world. But through its settlement by German colonists and knights of Christian brotherhoods it was always more closely associated with Germany than any other state until modern time. At various periods it was commercially dependent upon Lübeck and Hamburg. The Polish overlordship was succeeded by Swedish control in 1621. The eighteenth century saw the gradual advance of Russian power to the Baltic.

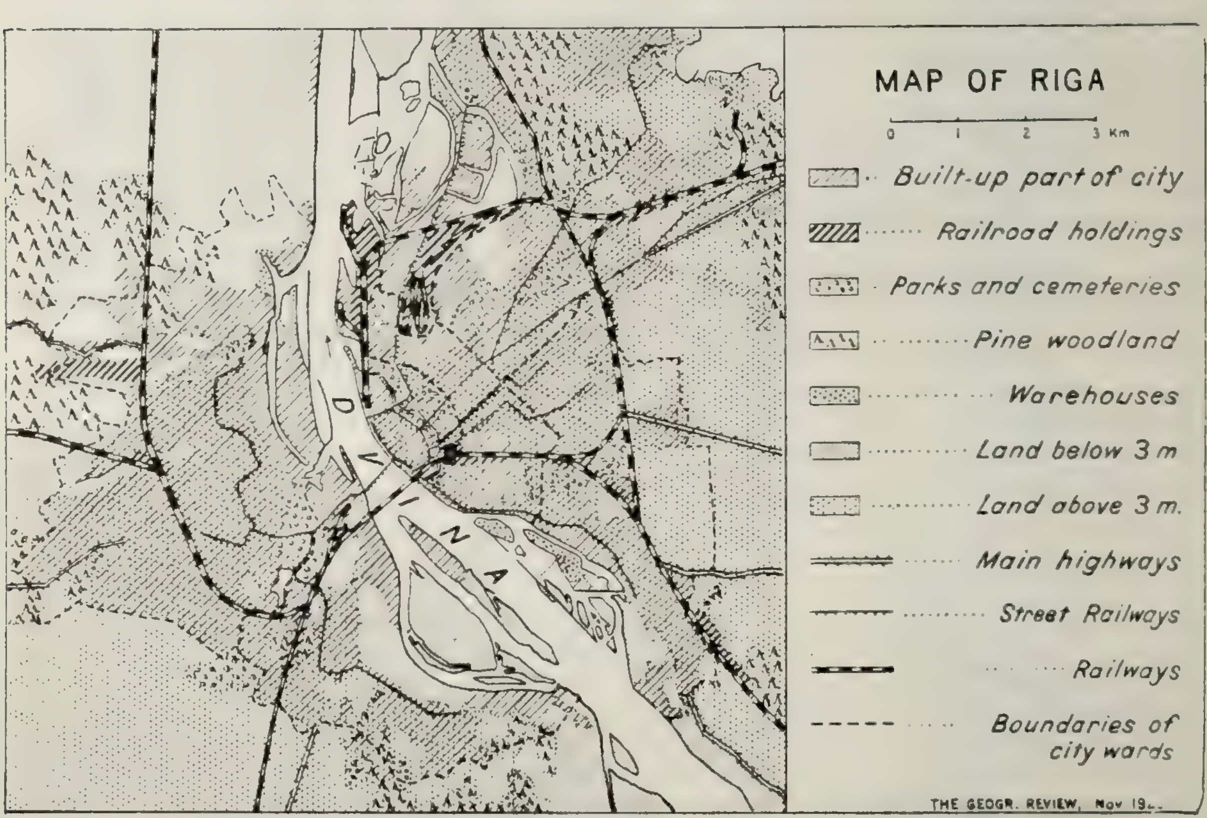

Fig. 1—Map of Riga (redrawn from Figure 6 of the paper discussed in the text).

The physical aspect of the city was entirely changed during the nineteenth century. In 1860 its walls disappeared. From 1875 to 1896 its port was practically rebuilt. From 1867 to 1897 its population increased from 103,000 to 281,000. Letts constituted 42 per cent of the population in 1897, Germans 25 per cent, Russians 17 per cent. German, Lettish, and Esth Protestants made up 63 per cent of the population, Catholics 10 per cent, Jews 8 per cent. The rest were composed chiefly of Greek Orthodox and Uniats.

In former times the harbor of Riga was frozen from two to three months a year, but ice breakers have reduced this to a month at the most. Of the total tonnage (nearly two million net registered tons in 1912) about one-fourth was Russian, less than one-fifth German, one-sixth British, one-ninth Danish. There is a considerable river commerce tributary to Riga. The valley of the Dvina had the first and most important railway into the Russian empire. At the present time three principal Russian railways converge at Riga, and they tap the region extending from the northern forest country across the black earth belt and into the steppe region. A map (Fig. 3, p. 27) shows the hinterland of the Baltic ports of Russia and especially the rail hinterland of Riga. In 1913 the Baltic ports handled 40 per cent of the exports and 47 per cent of the imports of all Russia—Riga alone taking care of 17 per cent in value of the exports. Thanks to its transit trade the city has been since 1896 the most important export port of the Russian Empire.

Two other extremely interesting maps accompany the paper. They show the divisions of space in and about Riga. We reproduce one of them as an example of the geographical treatment of a city (see Fig. 2 on p. 35). The paper contains an analysis of the various city elements with a description of the characteristics and functions of each part in terms of the origin of the materials of commerce and life of the city. The author has worked out an unusually interesting analysis of the surroundings of a city and its internal structure and functions.

Population Distribution in the French Alps. A very complete geographical monography of the French Alps is promised through the work of the Institut de Géographie Alpine of Grenoble. The latest contribution towards this end is a study of population distribution by Jean Robert (La densité de population des Alpes françaises d'après le dénombrement de 1911, *Rev. de Géogr. Alpine,* Vol. 8, 1920, pp. 5–124). The author's viewpoint is important. "The density of population is as it were the synthesis of all the geographical phenomena: it expresses eloquently the manner in which man has taken advantage of the land he occupies."

This conception leads to the principle adopted for the expression of population density. It is determined not according to the total land area but according to the "exploitable" area. The unutilizable spaces—the snows, glaciers, rock peaks—are excluded. The method of arriving at this area is interesting. For detailed analysis of such a feature as population distribution in such a region it is inadvisable to use an arbitrary limit such as the 2,000-meter line adopted by Blanchard in the determination of the mean altitude of the natural regions of the French Alps (*Recueil des Trav. de l'Inst. de Géogr. Alpine,* Vol. 7, 1919, pp. 245–308). On the 1:50,000 maps, with the aid of supplementary sources including photographs, were traced the upper limits of the forests and pastures including all features that appear susceptible of human utilization. An example will illustrate the significance of this method of expression. In the northern Alps the central massifs have a population of 28 per square kilometer (72 per square mile) in relation to the exploitable surface, of 15 (38 per square mile) only if the total surface is considered. Thus proportionally in spite of the high altitude they support a population as great or slightly greater than the lower, richer region of the pre-Alps (27 per square kilometer). The central massifs make the most use of the abundant pastures, the pre-Alps suffer from inaccessibility and the superior attraction of adjacent regions. The hydroelectric establishments for instance are all on the periphery of the pre-Alps, if not entirely beyond its borders, and distribute power to the neighboring valleys with little profit to the mountains. A table of the exploitable areas by natural region and by commune is given at the end of the article. It might advantageously have been paralleled by the total areas; for, after all, the unexploitable area has a significance if merely of negative character.

The first question of expression settled, the second that arises is the disposition of the rural and urban populations. Urban population is here considered as that residing in agglomerations of over 3,000. In subtracting such from the total figure an allowance of 3,000 is made for each agglomeration.

The large scale map (1:3,000,000) on which results are shown is a "mosaic," the author considering the "speaking" qualities of this to be greater than the isometric form for a region where the contrasts between neighboring communes are often very sharp. There are, for instance, scantily peopled communes of the Chartreuse massif where, chiefly through monastic influence, 20,000 hectares of woodland has been preserved, side by side with the densely peopled communes of the Grésivaudan valley.

A small map shows distribution by natural regions. There is a clear though progressive distinction between the northern and the southern sections, the division being the climatic line recognized by E. Bénévent (La pluviosité de la France du Sud-Est, *Recueil des Trav. de l'Inst. de Géogr. Alpine,* Vol. 1, 1913, pp. 323–442), which may here be approximately described as the divide between the basins of the Isère and the Durance. The average density of the northern section is 40 to the square kilometer (103 per square mile), 55 (142) if cities be included; for the southern section it is 17 (44), 19 (49) with the inclusion of cities.

The mean altitude of the southern Alps is lower, but in other respects it is less favorable to human occupation than the northern region. Structure, relief, and the nature of the rocks make a country more broken and difficult of access. In addition to this are climatic disadvantages. Dryness of the limestone areas is accentuated by less abundant precipitation. Alluvial and glacial deposits are more scant. There is nothing in the south comparable with the dense population of the transverse gorges, *cluses*, of Faucigny, Annecy, Chambéry, Grenoble, and the subalpine depression of the north. The nearest approach is in the depression of the Durance, where some progress has been made in the line of industrial development. On the contrary the disproportion between north and south diminishes at higher altitudes. It is noteworthy that here the most fully occupied, if not the most densely peopled, zone is that from 400 to 1,000 meters.

The population map also includes certain bordering regions. Thus the Riviera is included, though strictly it is extra-Alpine. There is a close relation between the Côte d'Azur and the mountains to whose protection its marvelous climate is due. The population density (total) of the narrow strip is 503 to the square kilometer (1,300 to the square mile). It is impossible to separate the rural and urban elements, for most of the agglomerations have more than 3,000 inhabitants.

AFRICA

A Phase of the Racial Problem in South Africa. In the intensive study of the distribution of the white man in South Africa, and of the relation of that distribution to native races, important data may be obtained from the paper "The Transition from Tribalism to Individualism" by J. R. Kingon (*South African Journ. of Sci.*, September, 1919, pp. 113–157). It deals chiefly with the change now taking place in the tribal system of government of the natives and sets forth the various factors that operate in the evolution of the native peoples of Kaffirland where, before the white colonists came, the natives lived a pastoral life, moving about with their herds from place to place in search of pasturage and cultivating small gardens for immediate needs. Their wealth was represented by cattle, sheep, and goats. Corn and sugar cane were among the products of the gardens. Flexibility in physical arrangements was a principal object so that the tribe could flee at a moment's notice and take its cattle to a place of safety.

Only when the white man came into the region was this general economic system seriously changed. The white man set up a border zone to the east of the colony. This however was transgressed by the native to the confusion of the white settlers. He drove off the cattle of the farmers and kept the country in a constant state of unrest. After various less successful expedients had been tried a chain of forts was built along the frontier at intervals, and by signaling between forts the military were able greatly to reduce cattle stealing. With the extension of the colony eastward more and more of Kaffir territory was absorbed by the white man. In 1820 British settlers began to arrive and were established in the eastern part of the colony. The inclosure of farms commenced and the native found himself more and more limited and inconvenienced. If he stayed on his farm, he had to pay rent; if he moved off it, he had to go to the native reserve or settle wherever he could on unoccupied lands. Side by side with these limitations in the occupation of land and the number of his flocks and herds other factors operated.

Formerly the native lived in a state of tribalism, the cementing principle of which was witchcraft; he accepted the principle of communism in land and of complete responsibility to the tribe from the standpoint of customs and ownership of property. He now found himself forced to accept the principles of *individualism* and *private property in land.* In his education through missionary agencies he acquired a new psychology. The opening up of roads favored the spread of the new ideas. Many trading stations were established. Periodical fairs were instituted, the most important being the one at Fort Wiltshire (Willshire) in 1824. The reports of local British officials for 1910 and 1912 show a rapid increase in the number of trading stations, the volume of goods, and the effect upon the native in development of the wealth of his country and his way of life. European clothing has been adopted, dwelling houses improved, flocks and herds increased, and there has also developed an export trade in wool and hides.

The effect of these changes upon the native way of life is perhaps equally clearly seen if we turn to two examples of the former "accidents" that affected him. Tribal wars have been greatly reduced. We do not have in recent times a repetition of such wars as that which terminated in 1835 (that extended over a period of about 18 years) and which destroyed about one-half the population of an immense region west of Delagoa Bay. Formerly the native herds were devastated by drought. The effects are now ameliorated somewhat. In 1912 the cattle fever broke out among the herds of the eastern coast and wrought such havoc as to affect the supply of milk. Plowing was cut down, and the subsequent harvest reduced. With continuing drought and the drying up of the pasturage the animals died in large numbers. For long a state of exigency existed in the matter of food which would surely have led to very great mortality had it not been for the better organization of the present in the matters of transportation and relief.

ASIA

Explorations in Inner Arabia. On current maps of Arabia the unexplored central upland of the southern Nejd is represented as trending in a direction west of north, and the main drainage lines are made to run northeast. Of the people we have hitherto known very little, and almost all of that came into the literature secondhand. Sadlier, in 1819, was the first European to cross Arabia from sea to sea and one of the first to reach Nejd. Only a few explorers, mostly English, have since penetrated any portion of the vast interior. Permanent water pockets were reported and substantial resources were supposed to exist; for there were many towns, and the native Wahabi warriors gave frequent proof of their power. They have always led a wholly independent political life and have never been conquered throughout history. Doughty's admirable "Travels in Arabia Deserta" (1888) and Hogarth's "The Penetration of Arabia" (1904), have long been the standard writings on the subject. As late as 1904, according to Hogarth, a descriptive geography of Arabia by Ritter, published in 1845, was still a first-rate authority for nearly a million square miles of that country, so inaccessible had it been for modern explorers. Of the great southern desert we knew "about as much as Istakhri knew in the tenth century" according to the same authority, who estimates that not a hundredth part of the peninsula has been mathematically surveyed. In 1909 Carruthers made a remarkable journey in northwestern Arabia which was described (Douglas Carruthers: A Journey in North-Western Arabia, *Geogr. Journ.*, Vol. 35, 1910, pp. 225–248) in a manner worthy of comparison with Doughty's best. The Southern Nejd has recently been explored by Philby who has given a striking picture of the physical and human geography of the region. Philby's account is accompanied by a map showing detailed locations and relief (H. St. J. B. Philby: Southern Najd, *Geogr. Journ.*, Vol. 55, 1920, pp. 161–191). It seems as if this vast desert region (Arabia is more than a third as large as the United States) were being conquered piece by piece by men of exceptional character, the literary quality of whose writings reflects the fine spirit of their extraordinary feats.

The central geographic feature of inner Arabia is the Tuwaik, an upland belt 400 miles long with an average breadth of 20 miles, falling off steeply to the west and gently to the east after the manner of a cuesta. Through it run eastward-trending drainage lines, and about it and in favorable spots within it are groups of oases "which alone give the Arabs a respite from the nomad life." East of it is a barren desert which extends from an elevation of 2,000 feet above sea level to the coast of the Persian Gulf. Westward the Tuwaik is also flanked by sand deserts. To the south is a desert that has never been traversed by a European, a wide expanse of waterless country which includes the so-called Empty Quarter. Surrounded by regions difficult to cross, the central upland is the home of the Wahabis who are hostile to all about them and have within themselves suffered dissension and war.

The towns are of course closely connected with the drainage lines. One of the most interesting is the oasis of Hair. The population of four hundred consists entirely of people of negro descent who cultivate the groves and fields for the absentee owners—Bedouin tribes that visit the oasis but once a year at the date harvest to collect their rents and also during the month Ramadan "if it falls in the summer season." In one oasis, locally known as "the Wadi," the nomadic dependents of the oasis "retain their proprietary rights in the palm groves while wandering with their flocks and herds in the sand deserts to the north and south." There is the once important city of Yamama which appears to have been destroyed by a flood. The site is now occupied by a straggling village in the angle between two stream channels. Other towns suffer even today. In at least one wadi water flowed in 1917 where it had never flowed before within the memory of man, working havoc with the oases along the course of the channel and taking heavy toll of human lives, camels, and sheep. One of the temporary but inconvenient effects of such a flood is to fill all the village wells located along the gravelly floors of the dry stream beds.

Hauta is hemmed in by high cliffs and with its date groves, corn lands, and deep wells is both self-supporting and impregnable. No Arab force besieging it could long sustain life in the arid desert about it. Today Ibn Saud, Chief of the Wahabis, allows this town complete political autonomy, receiving only a small tax by way of recognition. Many new Wahabi towns have sprung up throughout the country in the last decade as a result of a vigorous religious revival known as the Ikhwan movement. The scattered character of the settlements has made it difficult to keep them in a state of political coherence, since there is no effective rallying point in which discipline can be taught and strength accumulated for wide conquest. The present ruler has made a dozen towns and villages of recent growth centers of military, political, and religious power.

One of the interesting minor pieces of information relates to the trade that crosses the region from the east-coast ports of the Persian Gulf to the west-coast ports on the Red Sea—piece goods, tea, sugar, and groceries passing westward in exchange for the coffee of Yemen.

Of different character but of first importance is a recent paper on Arabia by D. G. Hogarth (War and Discovery in Arabia, *Geogr. Journ.*, Vol. 55, 1920, pp. 422–439). The paper is a summary of recent explorations in their bearing on two chief points: (1) the character of the watershed between the northeastward-flowing drainage of the back country of the Hedjaz and that of the Red Sea slope; (2) the longitudes of inland points of the Hedjaz. A rather large body of data on these two matters was gathered under the severest handicaps chiefly by army officers during the war. The information is sufficiently full to permit the representation of the main topographic outlines of the western fringe of Arabia with approximate accuracy. The paper is illustrated by a map of the Hedjaz (which now takes precedence over earlier ones in the matter of more accurate representation of towns and drainage lines), and by photographs of Medina, including a unique airplane photograph of part of that city.

GEOGRAPHICAL NEWS

Plan of the Bicentenary Expedition to the North of Greenland. In the year 1721 Hans Egede left Copenhagen for Greenland; with this event was started the systematic colonization of the vast Arctic territory by Denmark. In celebrating the bicentenary of this colonization it is natural not only to review what has been achieved but also to look forward to what still remains to be done both in administration and in research.

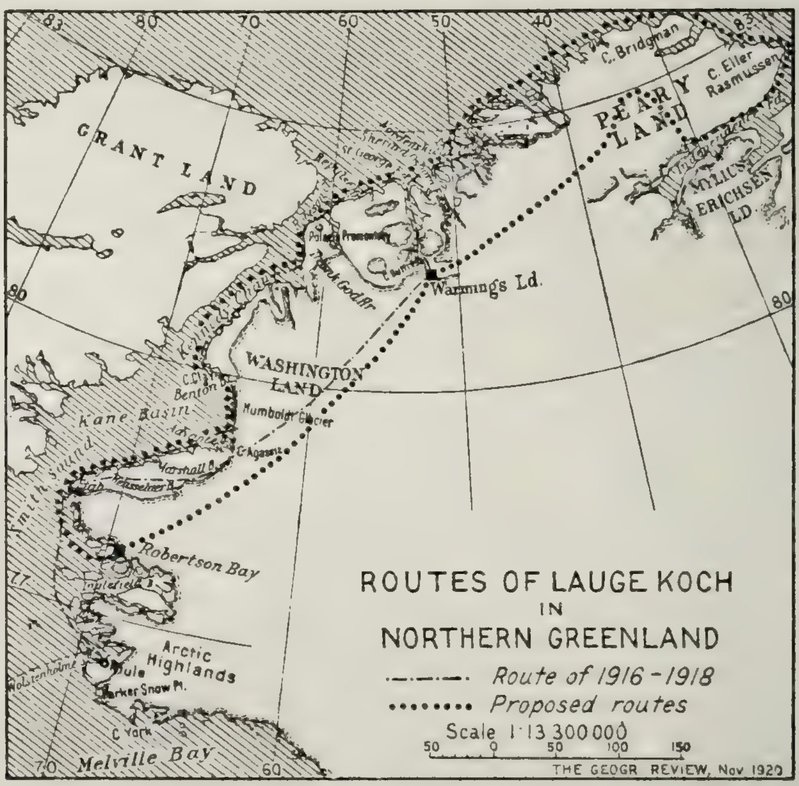

Fig. 1—Map showing Lauge Koch's routes in northern Greenland. For an outline of Koch's work in 1916–1918 see "The Second Thule Expedition to Northern Greenland, 1916–1918" and "Scientific Results of the Second Thule Expedition to Northern Greenland, 1916–1918," *Geogr. Rev.*, Vol. 8, 1919, pp. 116–125; 180–187.

The whole coast line of Greenland is now known. Every point of the coast, extensive as that of a continent, commemorates by its name the glorious achievements of some explorer. As a rule the greater nations were ahead of Denmark as far as the discovery itself was concerned, but it may safely be said that Danish research has always deepened and perfected the knowledge of the new coast lines. Stubbornly and unweariedly the Danes have carried their flag to the north on both coasts.

The coast of Peary Land, the remotest, most inaccessible part of Greenland, has been reached from both sides. The Denmark Expedition reached as far as Peary's cairn on Cape Bridgman; and the Second Thule Expedition, in which I myself took part, reached De Long Fiord. In this region there still remains a stretch of coast that no Dane has ever seen; and the interior of this country (Peary Land), almost as large as Denmark, is still absolutely unknown.

On the Second Thule Expedition, conducted by Knud Rasmussen, it fell to myself not only to map out great ice-free territories, which had hitherto been unknown, but also to demonstrate that geologically these new territories are among the most interesting in Greenland and that the so-called Caledonian Fold, which had hitherto been known to exist only in northern Europe, stretched across to the other side of the Atlantic.

Although these results are irrefutably proved by the collections which in spite of the greatest difficulties we succeeded in bringing home, I realized even while I was working in the field that great problems still remain to be solved. Another expedition was planned whose aim was to be exclusively geological and geographical research.

A headquarters with a wintering station is to be established in Robertson Bay in Inglefield Gulf. From here I am to start on the following journeys:

1. A large provision cache for future journeys is to be taken across the inland ice from Inglefield Gulf to Warmings Land, south of Sherard Osborn Fiord. (The writer's map of the regions surveyed by the Thule Expedition has been printed and will soon be published.) Its transportation will take place in the late summer, when the temperature is comparatively high and the surface snow is melted down or compressed. For this purpose Cleveland tractors will be used, as they will be able to work across the ice-free marginal zone at Inglefield Gulf.
2. The next year the same journey will be repeated in dog sledges to the cache and from there to the interior of Peary Land and to the North of Adam Bierings Land, an advanced base being established in Valmuedalen. From here various short journeys are to be taken: to Independence Fiord, where Mylius Erichsen's account of his journey is to be fetched, and northwards to Böggild's Fiord. On the way back the part of Wulff's Land and Warmings Land that I did not succeed in mapping on the Second Thule Expedition will be surveyed. The main cache will be passed on the way back in August.
3. The following spring I shall proceed from headquarters along the coast, through Robeson Channel, and further to the north of Peary Land into Independence Fiord.

From here I go on to my main cache, from which I start on the homeward journey.

My Danish companion on these travels will be Mr. C. F. Slott, an engineer who during many years and in many countries has devoted himself almost exclusively to the study of tractors and their practical working. On the sledge journeys I shall be accompanied by polar Eskimos.

The cost of the expedition is estimated at 110,000 Danish kroner, part of which has been guaranteed by the Danish Government. The remainder was raised by a committee under the chairmanship of Mr. C. F. Wandel, former Rear Admiral of the Royal Danish Navy.

The Government has also placed a ship at our disposal to take the expedition and its stores to Inglefield Gulf. This ship left Copenhagen on July 15, 1920.

Lauge Koch

GEOGRAPHICAL REVIEWS

ANTWERP AND ITS ECONOMIC SIGNIFICANCE FOR SWITZERLAND

V. BIERKENS. **Le Port d'Anvers: Son Avenir, Son Importance Economique pour la Suisse.** Maps, bibliogr. *Bull. Soc. Neuchâteloise de Géogr.*, Vol. 28, 1919, pp. 5–208.

This monograph was written during the first years of the war, when the author was an exile in Switzerland. He offers an apology for the restrictions imposed on him by the conditions but needs to make none; he has gleaned excellent material from different fields, has wrought it into a consistent whole, and has made a substantial contribution to the commercial geography of central Europe.

The first part of the study, making somewhat less than half, covers the port of Antwerp. The author describes the situation and equipment of the port and the projects for its improvement, with sketch maps which indicate roughly conditions as they were in 1914 and plans for the future. There follows an analysis of the trade of Antwerp compared with that of its competitors. The most important economic advantage possessed by the port lies in the relative equilibrium of its imports and exports. The figures for 1912, for Antwerp and its two most serious competitors, were as follows:

	Antwerp	*Hamburg*	*Rotterdam*
Imports, tons	10,080,000	16,648,000	20,850,000
Exports, tons	8,076,000	8,109,000	5,990,000

Thus the tonnage of wares offered for export at Antwerp amounts to four-fifths of the tonnage of imports, as compared with one-half or one-third at the other ports. In bulk the correspondence of imports and exports is even closer. Furthermore, the highly industrialized region of northwestern Europe provides a remarkably varied assortment of freight, of which some is suited to tramp steamers and some to regular liners. All these factors contribute to attract shipping, to lower freights, and to secure good service.

The most direct competitor of Antwerp is Rotterdam, which has enjoyed an immense increase of trade since the cutting of the Nieuwe Waterweg which has provided a deep channel from the Hook of Holland to the quays. The single factor counting most in favor of Rotterdam is, of course, the continuation inland of its waterway by the Rhine; and it is natural that Antwerp should seek to divert to its docks part of the great current of trade flowing up and down the river valley. The natural connection by the eastern Scheldt is barred by the embankment of the Dutch railroad from Flushing, and the connection now afforded by the canal Wemeldingen-Hansweert is unsatisfactory in several respects, of which the extended mileage is but one. In a chapter of thirty pages the author discusses the problem of grafting effectively the traffic of the Schedlt and the Rhine. He dismisses as impracticable the idea of a heavy duty freight railroad (*Massengüterbahn*). In view of the relatively short distance and consequent high cost per mile of transshipment, and of the impossibility of linking such a line to the existing railroad systems, he is undoubtedly right.

Of projected waterways he discusses four. For economic and political, as much as for technical, reasons he surrenders the hope of gaining for Antwerp the trade of the lower Rhine and of the Westphalian district, and he believes that the only feasible project is that of Schneiders, for a canal of three meters depth, floating boats of 2,000 tons, from Cologne by Aix-la-Chapelle, Maastricht, Hasselt, and Aerschot to the Brussels-Antwerp canal. This plan would surrender to Rotterdam all the Rhine trade up to Düsseldorf but would allow Antwerp to compete for the trade of the middle and upper Rhine and would tap the coal regions of Aix and Dutch Limburg. The economic arguments advanced in support of this plan appear to be sound. The technical difficulties, however, which would be involved in the construction and operation of a canal crossing a crest 145 meters above sea level need only be suggested. Even in 1914 the estimated cost of construction was put at 100 million francs, and the actual cost would certainly have exceeded that figure by an indefinite amount. At the present time the project must be dismissed as chimerical. The world cannot afford to invest its scanty fund of available capital for the construction of artificial waterways to compete with rivers that serve the traffic perfectly well. Antwerp would get some benefit by the canal, although the estimate of an annual traffic on it of four million tons appears extravagant. But it would certainly be impossible now to find investors or even taxpayers who would provide the money necessary for this scheme to attract trade out of its natural channel and over a hilltop.

In the second and larger part of the work the author discusses the trade of Switzerland in general and Swiss trade by way of Antwerp in particular. He distinguishes two separate zones, making up together Antwerp's commercial hinterland. The first, which he terms the Franco-Latin zone of penetration by land, comprises the North and East of France and parts of Switzerland and of Italy; this is served mainly by railroads. The second, the Germanic zone, depends on the artery of the Rhine; it reaches into Germany and Austria and touches Switzerland but finds its limits at the headwaters of navigation. Both zones are capable of extension. The opening of the tunnel of Moutier-Granges, connecting with the tunnels of the Lötschberg and the Simplon, will facilitate the penetration of southern Switzerland and upper Italy; and the author dreams of an extension of Rhine navigation to the Lake of Constance with branches linking the lakes of Zürich and Geneva.

In this, as in the first part of the work, the author shows the enthusiasm of an advocate rather than the measured deliberation of a judge. One hears him always crying, "This way to Antwerp!" His good faith is above question. He states with frankness and in full the reasons why a larger proportion of Swiss trade does not pass by the Belgian port. His analysis of the commercial relations and interests of Switzerland is excellent. His discussion of commercial policy and of transportation policy is well informed and interesting. Anyone who reads the book will profit by its compact and lively description of European trade as it was before the war. Only when the author begins to argue that European trade currents should change their course, and particularly that more Swiss trade should flow through Antwerp, will the reader be inclined to reserve judgment. The war has so far dislocated the commercial mechanism that prophecy now seems fruitless. As a record of the past, at least, the study has permanent value.

CLIVE DAY

THE ITALIANS IN SWITZERLAND

HEKTOR AMMANN. **Die Italiener in der Schweiz: Ein Beitrag zur Fremdenfrage.** 48 pp.; maps. Ernst Finckh, Basel, 1917. 8½ x 5½ inches.

The new boundaries of Europe follow rather closely the language frontiers (often wrongly called the ethnic frontier), and provision is made for a still closer approximation of new boundaries to lines of language and nationality. For example, Germany and Poland have signed a treaty which corrects the boundary between them as laid down in the treaty of Versailles, small Polish districts in Germany being traded for German districts in Poland. Again Greece and Bulgaria are permitted to exchange their respective nationals. In addition, almost all of the territorial transfers carry with them a provision that citizens of different language from the prevailing one may choose to move out of the country in which they find themselves and into the country of their own speech.

These provisions and circumstances set in relief and increase the importance of future movements of population of an opposite kind. One of the most striking cases is the strong Italian current that had set toward Italy in the years before the war and which will doubtless be resumed as soon as normal conditions are established. The author of the publication under review has made a thorough study of Italian emigration to Switzerland. He finds that the number of Italians increased between 1888 and 1910 from 41,883 to 202,809. At first they came as workmen on the railroads and tunnels. With the rise of industry in Switzerland they were drawn to the large manufacturing centers. Later still, they settled in the smaller towns, and today they are to be found practically everywhere. When they first came to the larger towns, they were engaged principally in the leading industries; they are now found also in the smaller industries. In the smallest towns one frequently comes upon the Italian cobbler or tailor. The figures representing their growth in industry are truly surprising.

The paper is accompanied by two striking maps, one showing the distribution of Italians in Switzerland in 1880 when they were found chiefly along the line of the railway through central Switzerland and about the border of Lake Geneva; the second map, for 1910, showing them scattered broadly throughout the country. They have displaced Swiss labor in the textile mills and have furnished the labor supply for the large number of hotels as well as for the roads that have been built in Switzerland in the last fifty years in connection with the development of scenic features and tourist travel. They publish newspapers and periodicals in large numbers in their own language. They have their own churches and live in separate colonies. They do not willingly obey the health regulations, reluctantly send their children to school, furnish a greater number of criminals than any other element of the population, contribute toward social unrest of almost every kind, and do not tend to mix with the German and French elements of Switzerland. In addition, they retain an attachment for the home country that is far greater than in the case of the Italian in America. Nearly all of them come from northern Italy and return there frequently. They send 20,000,000 francs back to Italy each year according to postal statistics (their total savings exceed this amount), and in 1910 they imported about 35,000,000 francs' worth of foodstuffs of Italian origin. The author fears serious political consequences and compares the situation with that in South Africa where the English stream of colonization led through complex stages to the Boer War and English domination.

These changes have taken place in just the period when Swiss emigration has been heavy and in which the birth rate of native Swiss has declined, while the birth rate among the Italians is high. Unlike the Italians Swiss citizens who have gone to other countries have given very little financial or commercial support to the home country.

CHINA: HER INTERNATIONAL RELATIONS AND A SKETCH OF HER DEVELOPMENT

H. B. MORSE. **The International Relations of the Chinese Empire. Vol. 1, The Period of Conflict, 1834–1860.** xxxix and 727 pp.: maps, diagrs., ills., bibliogr., index; **Vol. 2, The Period of Submission, 1861–1893.** xiv and 479 pp.; maps, diagrs., ills.; **Vol. 3, The Period of Subjection, 1894–1911.** xvii and 530 pp.; maps, ills., bibliogr., index. Longmans, Green & Co., London, etc., 1918. $8.50 each. 9 x 6 inches.

K. S. LATOURETTE. **The Development of China.** xiii and 274 pp.; bibliogr., index. Houghton Mifflin Co., Boston and New York, 1917. $1.75. 8 x 5½ inches.

Every student of Far Eastern affairs rejoices in the completion of Morse's monumental work, the first volume of which appeared in 1910. The painstaking character of that volume, whose every statement was supported by reference to original documents many of which had never before been published, gave the work at once a pre-eminent standing among the numerous books about China. The long delay in the appearance of the second and third volumes has been due in part, it is understood, to the illness of the author.

The volumes are supplied with excellent maps, and the text is profusely annotated with references to authoritative sources, among which are the unpublished letters of Sir Robert Hart who was either a counselor or participant for half a century in nearly every important transaction affecting the foreign relations of China.

The first volume covers a period extending from the appearance of the Portuguese in 1516 to the close of the second war with Great Britain in 1860. "The Period of Conflict" it is called, because with the taking of Peking in 1860 the active opposition of the imperial court to western intercourse was brought to an end. Volume 2 deals with the "Period of Submission," a period in which "the Chinese Government accepted submissively the results of the treaty settlement of 1858 and 1860" (p. v). Volume 3 covers the years between 1894 and 1911, styled the "Period of Subjection," during which China suffered from the aggression of Western powers and the Manchu dynasty declined rapidly to its fall.

The author has done well to make the war of 1894 between China and Japan the beginning of a new period, for it was that war which inaugurated the series of disasters that have led to the present deplorable state of affairs in the Far East.

The cession of southern Manchuria; the protest against it by Russia, France, and Germany followed by its retrocession; the compensation given to Russia for her good offices consisting of railway rights in Manchuria; Germany's seizure of Kiaochow Bay; Russia's lease of Port Arthur and Dalny; Great Britain's lease of Weihaiwei and enlargement of the territory of Hongkong Colony; France's lease of Kwangchow-wan; the declaration of spheres of interest and talk of partition which precipitated the "Boxer" rising; the heavy debt so demoralizing to her finances placed upon China in punishment; the Russo-Japanese war and the annexation of Korea; the capture of Kiaochow by Japan in 1914; the Twenty-one Demands and the conventions wrung from China in 1915, together with the protest against the Shantung clause of the Treaty of Versailles—are all closely connected links in a chain of events that have followed one another naturally as results of that unrighteous and unnecessary war of 1894 waged partly to silence domestic strife in Japan over desired constitutional reform and partly to gratify the ambition of the military party there for the enlargement of the empire and to win a standing among the great nations of the world.

But that war was also responsible indirectly for the birth of the reform movement in China, for the downfall of the Manchus, and for the establishment of the republic. In that respect, therefore, it may be considered a blessing in disguise.

The second book under review is intended primarily as a text for college students, but it will also serve the general reader as an introduction to more detailed studies such as that reviewed above. Professor Latourette, now of Denison University, was for some years a member of the Yale Mission at Changsha, in the province of Hunan, China, and since his return to the United States has continued his interest in China and in the general condition of affairs in the Far East, as is evidenced by this volume and its companion, "The Development of Japan" (reviewed in the August number of the *Geographical Review*).

It is no easy task to compress the history of four thousand years into the brief space of less than 300 pages, but the author has accomplished this task very successfully. "The Geographic Background of Chinese History" is the theme of the first chapter. China perhaps better than most countries illustrates the influence of geography upon history. Cut off from the rest of the continent by lofty ranges of mountains on the west and by great deserts on the north, and protected by the sea on the east and south, China, so long as navigation was dependent upon sailing vessels, was isolated from the rest of the world—though in ancient times there was a limited intercourse with the western world—and developed a civilization distinctively her own. Foreign influence was almost entirely unknown until the advent of Buddhism in the first century of the Christian era. Moreover the Buddhist missionaries came and went for six hundred years before the religion became firmly established in China. China's immediate neighbors were all less civilized than herself and naturally fell under her influence, all but Japan becoming her vassals.

It was natural, therefore, for the Chinese to look upon Europeans, upon their first arrival in China, as inferior to themselves, barbarous peoples who had not yet enjoyed the enlightening influence of the Middle Kingdom.

The early history of the old empire is passed over very briefly, but is presented in an attractive manner. The author avoids so far as practicable the use of strange names. For the benefit of those who may want them they are in some instances mentioned in the footnotes.

In referring to the origin of the Chinese people and their culture, which he regards as shrouded in obscurity, the author (p. 15) makes mention of the theory held by some that the Chinese came originally from the Tigris-Euphrates Valley. Attention is called to the curious parallels between Chinese civilization and that of the Sumerians.

The reviewer has discussed this question elsewhere but may state here that an explanation of the striking parallels between the two cultures is best found by assuming that both had a common origin in Central Asia, where as Pumpelly and others have shown, there are the remains of ancient settlements whose foundation in some instances must be carried back to 8,000 B.C. For thousands of years the gradual desiccation of that region has forced an emigration of peoples both eastward and westward, and the earliest traditions of the Chinese undoubtedly point backwards in that direction.

The author gives a passing glance at the influence of Greek art upon Chinese Buddhism (p. 46) which, as he observes, "has only recently been disclosed." The conquests of Alexander undoubtedly introduced Greek art into northwestern India and central Asia, and the sculpture of Gandhara shows us that the Greek Apollo was the model upon which the ordinary Chinese images of the Buddha have been formed. A Buddhist theology modified by Christian influence, teaching an immortality of happiness, found a much more ready acceptance among the Chinese than the pessimistic doctrines of the founder of Buddhism.

Attention is called also to the fact that the Chinese emphasize society as contrasted with the individual. "The will of the individual is subordinated to that of the group" (p. 88). It is interesting to note that contact with the West is rapidly destroying this feature of Chinese social organization, Christian missionaries emphasizing the responsibility of the individual. The matter has received considerable attention in certain Chinese circles where it is feared that the growth of individualism will tend to laxity in morals, since the chief sanction of the moral code in their estimation is the accepted religion, whose most striking requirement is obedience to elders and adherence to the practices of the ancestors whom they worship.

The recent history of China is treated as satisfactorily as can be expected in so brief a survey, but suffers here and there from the omission of details which are necessary to a correct understanding of the subject.

With respect to the seizure of the leased territory of Kiaochow and the presentation of the Twenty-one Demands, Professor Latourette says: "These demands [those relating to Shantung] would not only make Japan the successor of Germany in this wealthy and strategic province, but they would give her more than Germany had ever had" (p. 221). . . "The effect [of the Twenty-one Demands] was to make Japan the dominant power in China, at least until the European War should be over. However, instead of leading to an alliance between the Japanese and Chinese, in which the latter should give themselves willingly to the leadership of the island kingdom and the two present a united front to the world, it aroused among all Chinese a helpless but bitter hatred of Japan" (p. 224).

Japan would seem to have missed the "opportunity of a thousand years" as some of her publicists have expressed it, in neglecting to win the confidence of the Chinese people by an immediate return of the captured port and its privileges to the Chinese government.

E. T. Williams

The Political and Economic Development of Central America

D. G. Munro. **The Five Republics of Central America: Their Political and Economic Development and Their Relations with the United States.** With introductory note by J. B. Clark. xvi and 332 pp.; map, bibliogr., index. Carnegie Endowment for International Peace, Division of Economics and History, New York, 1918. 10 x 6½ inches.

With their settlements along the salubrious western highlands, thus facing the almost shipless South Sea, and barred from contact with European civilization by the monopolistic trade laws of Spain as well as by the untraveled, low, malarial forests of the eastern plains, the Central American countries received little stimulus to development from the outside world until long after independence. They are rich in minerals; they present great opportunities in tropical agriculture; they contain vast grazing lands. Within recent years an awakening has come. Interoceanic railways, projected water routes, the construction of the canal with the prospect of great markets at Panama, and, more recently still, the growth of an enormous trade in fruit along the Gulf coast, have given new life to these lands.

The purpose of the present volume is to contribute toward a fuller understanding on the part of the American people of the present economic and political conditions prevailing in these near-by republics. The author spent several months, not only in the large centers of population where white influence is strongest, but also in outlying sections of the country, visiting provincial towns and rural districts where aboriginal and mixed-race ideas and customs dominate, thus gaining an insight into the actual operation of the social, political, industrial, and economic systems.

Recognizing that the greatest obstacle to continuous progress is the lack of stable democratic institutions, the author ascribes this in part to *localismo* (which may be interpreted as the influence of a geographical medium which has tended to keep the countries divided into isolated sections), in part to their remoteness from the world's roadways, as also in a measure to the lack of racial homogeneity. He believes foreign interference in their domestic affairs, either to suppress revolutions or to support the military chieftain who happens to be in control, will never accomplish the ultimate object sought. The greatest possible help that we can give our Central American neighbors, in his opinion, is helping them to solve their social and educational problems that they themselves may overcome the natural obstacles to self-government.

The Primitive Civilizations of Peru

Carlos Wiesse. **Las civilizaciones primitivas del Perú.** 291 pp. Universidad Mayor de San Marcos, Tipografía "El Lucero," Lima, 1913. $1.00. 8½ x 5½ inches.

Although nearly seven years old this work is not so well known in North America as it deserves to be. Yet it is of great value, on the whole, to the student and to the teacher of American anthropology. In essence, it is at once a summary and an elaboration of the system of culture sequence founded by Uhle.

In his "Parte Preliminar" Dr. Wiesse discusses the question of geologic man in America. He accepts the findings of Hrdlička rather than those of Ameghino. In his discussion of the various phases of culture in America the terminology is unfortunate. Much is said of "paleolithic" and "neolithic" periods and cultures. To most North American anthropologists this classification will be distasteful because of the chronological element involved, an element quite out of place when attached to such cultures as those of the cliff dwellers, the mound builders, and the Changos. Some of the "paleolithic" cultures are extinct; others still exist. Another set of terms would have been better, and the classification of cultures itself is not above criticism, for the people of the shell heaps and the mound builders certainly do not belong in the same cultural category. Then, too, in his account of the historical development of the people in Mexico and Central America, Dr. Wiesse shows himself lamentably out of touch with modern research. On page 36 he says: "It is established that in the tenth century the Toltecs of the kingdom of Tula . . . marched to the east and then to the southeast, founding the cities of Palenque and Tixal (*sic*), then going north to the peninsula of Yucatán where the cities of Kabah, Uxmal, Chichen-Itza, Aké, Mayapan, and Izamal flourished." One is led to suspect that Dr. Wiesse is acquainted only by hearsay with the works of Brinton, Brasseur de Bourbourg, Bowditch, Spinden, and Morley.

From this point onward, however, the work is excellent, even though one may not wholly agree with some of it. The style and arrangement are above reproach. An admirable summary of Uhle's findings as to the earlier phases of the cultures of Chimu and Nasca is given. It is a pity that Uhle's dictum to the effect that the Nasca culture is the older should have been accepted so unquestioningly, but this is more than made up for by the very able description (pp. 66–72) of the still earlier and more primitive culture of the first coast dwellers. As the book was written before Spinden had published anything on the Archaic Type, there is no hint of the real significance of these very early people. Dr. Wiesse makes the important suggestion that there was not only contact but strife between the earliest folk and the more advanced Chimu and Nasca successors, a suggestion vividly supported by the vase paintings of the Chimus, in which battle scenes between well-armed and unarmed warriors are frequent.

Further, Dr. Wiesse gives a succinct and valuable outline of the chief features and problems of the Tiahuanaco culture. The chronological aspect of the discussion merits special commendation for its reasonableness; especially important in this connection is what Dr. Wiesse says (pp. 93, 94) of Llojepaya, a group of ruins on the present margin of Lake Titicaca. These ruins are in the same style as those of Tiahuanaco, and they prove that the Lake did not reach to Tiahuanaco at the time the two sites were occupied. This is an effective rebuttal of Posnansky's pretensions that Tiahuanaco was a port. A full, perhaps unnecessarily full, discussion of the long-since discredited conjectures of Angrand as to the possible Toltec origin of the builders of Tiahuanaco is given and a very full and valuable account of the god Huiraccocha (pp. 104–121). This is followed by a helpful and stimulating description (pp. 121–149) of conditions on the coast and in the highlands in the times immediately preceding the Inca period.

Dr. Wiesse begins his account of the Inca period with an exposition of the sanest theories concerning the origin of the Incas. Following in the footsteps of Uhle, he concludes that the Incas were neither more nor less than a tribe who lived near Cuzco, who were descended from former subjects of the old Tiahuanaco empire and who gradually built up a new empire for themselves. Equally satisfactory and sound is the date chronology. There is an important account of the history of the growth of the Inca power. The division of the Inca period into a "feudal" and a "unified" epoch is suggestive, original, and convenient. The further division into "dynasties" may seem to some unnecessary and unwarranted. Following this is a wholly admirable summary of the component parts of the Inca dominion, enriched with many apt quotations from old chroniclers. Then, with the work of Saavedra, Belaunde, Cunow, and Uhle for a basis, Dr. Wiesse gives a reconstruction of the social organization of the Inca dominion. The book is brought to a close by an account of the physical and intellectual aspects of the Inca culture which, though brief, is exceedingly comprehensive and valuable.

With the exception of a marked lack of care in the spelling of foreign proper names, the book is well documented, authorities in plenty being quoted. It is a pity that such errors as "Bourborug" for Bourbourg (p. 131), "Prescot" for Prescott (p. 161), and "Wilson" for Winsor (p. 164) should be allowed to creep into bibliographical references otherwise so excellent. Despite the faults which have been noted, one may say without hesitation that the book should stand beside Beuchat, Joyce, and Markham on the anthropologist's work table. It is the best summary of Andean anthropology to be found.

Philip Ainsworth Means

METEOROLOGY AND OCEANOGRAPHY OF THE ATLANTIC

Atlantischen Oceaan, Oceanographische en meteorologische waarnemingen in den, December, Januari, Februari, 1870–1914. With title in French: Observations océanographiques et météorologiques dans l'Océan Atlantique, Décembre, Janvier, Février, 1870–1914. 24 maps, with accompanying text. *Kon. Nederl. Meteorol. Inst.* [*Publ.*] *No. 110.* Seijffardt's Boekhandel, Amsterdam, [1918.] fl. 7.50. 20 x 18 inches.

There is a popular impression among teachers and students of meteorology that, the days of the sailing ship having largely passed, there is comparatively little interest or importance in the preparation and study of detailed charts and discussions of the meteorological conditions over the great ocean areas of the world. This is a highly mistaken point of view. While it is true that the fast passenger steamship is far less dependent upon weather conditions than is the sailing vessel, yet even the "ocean grayhound" has to meet and reckon with storms and ice and fog and is helped or hindered by the movements of ocean currents. Furthermore, the bulk of the world's commerce is carried on the slow-going "tramp" steamer, where high speed is not sought, and where the success of the "tramp" as a paying proposition is largely dependent upon making use of every favorable weather condition and avoiding, as far as possible, adverse winds, currents, and other obstacles to navigation such as fogs and ice. Thus, although the picturesque sailing ship is truly becoming more and more of a rarity, ocean navigation needs today, as it always has needed, the best possible information which can be supplied regarding the meteorology of the "seven seas."

The oceanographical and meteorological work of the Meteorological Institute of the Netherlands is well known. The observations made on board of Dutch ships during seventy years past have already furnished the basis for the preparation of valuable charts and discussions. One of the most complete of these publications deals with the Guinea Current and bears the date 1904. Other publications, for the most part covering the period of sailing vessels, have today less general interest. With the passing of the years the number of observations has decidedly increased, and, in consequence, it has become possible to determine, with greater and greater accuracy, the values of the various meteorological and oceanographical elements for the latitudes included between 50° N. and 50° S. The conditions over the Indian Ocean having already been discussed (*Publ. No. 104*), the next step was a similar discussion for the two Atlantic Oceans. The *Atlas* now before us is the first section, covering the months December to February, and is to be followed by sections dealing with the remaining months.

The observations dealt with were made mostly on Dutch vessels during the period 1870–1914, but data on winds and currents collected by the British Meteorological Office and the Deutsche Seewarte were also included for portions of the oceans where the observations made on Dutch vessels were few in number. The total number of observations employed was 1,562,463, covering currents, winds, pressure, air and surface water temperatures, and cloudiness. The reverse of several of the charts contains a discussion (in Dutch) of several matters which are of special concern to navigators, compiled by P. H. Gallé, assistant director, who, with Dr. J. P. van der Stok, had oversight over the preparation of the *Atlas*.

There are twenty-four charts in all. For each of the three months (December–February) we have the ocean currents; winds; isobars; isotherms for air and surface temperatures; sailing routes, storm tracks, fog and ice limits, and limits of the great wind belts. The frequency of directions of winds and currents is shown by "roses," the lengths of the different arrows indicating the percentages of frequency, while velocities, in nautical miles per hour for currents and on the Beaufort scale for winds, are shown by the number of barbs. The generalized currents and winds are shown on special maps by means of simplified arrows indicating the prevailing directions and velocities. Those who, for purposes of general information, desire only the larger facts will be especially interested in the three charts at the end of the *Atlas*, which show the sailing routes, ice and fog limits, storm paths, and the general boundaries of the wind belts.

R. DEC. WARD

INDUSTRIAL SUBURBS

G. R. TAYLOR. **Satellite Cities: A Study of Industrial Suburbs.** xviii and 333 pp.; maps, ills., index. (National Municipal League Series.) D. Appleton & Co., New York and London, 1915. $2.00. 7½ x 5 inches.

The author in his title has reference to the subsidiary centers of industry which have sprung up in recent years in the suburbs of our great cities. The book is one of the National Municipal League Series and is a critical investigation of the opportunities which the "made-to-order" cities possess and of the idealism which the science of town planning is trying to express. In its detail, it is a study of various types of satellite cities, Pullman, Norwood, and Oakley near Cincinnati, St. Louis' East Side, Gary, and Fairfield near Birmingham, Ala. The conclusion is reached that the factory gains by a transfer of its plant from a civic center to a suburban site; and this can be the more readily believed because in most of the manufacturing centers of the United States this movement has taken place and is gaining in force. The city is also the gainer in the relief from congestion.

The point of the book, however, is whether or not the people involved in the transfer are bettered or are exploited as industrial conveniences. Many cases of civic shortcomings on the part of the industrial leaders and the city authorities are instanced, and they lead one definitely to the conclusion that many of these satellite cities consider the problem of the laborer a secondary matter. In some cases the workman has found better living conditions; in more cases he is forced to commute or become the prey of building speculators. The problem of city planning is not solved—no attempt is made to point to a solution—but the book does in its clear presentation of the facts show the way definitely towards constructive progress.

ROBERT M. BROWN

THE GEOGRAPHICAL REVIEW

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Published monthly by the American Geographical Society
Broadway at 156th Street, New York, N. Y.

Price, fifty cents a number Five dollars a year

Entered as second-class matter, January 22, 1916, at the Post Office at New York, N. Y.,
under the Act of August 24, 1912
Acceptance for mailing at special rate of postage provided for in Section 1103, Act of
October 3, 1917, authorized on July 30, 1918

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Dr. Cleland is professor of geology at Williams College. His geological works include the textbook "Physical and Historical Geology" (1916). Among his geographical writings note may be made of an excellent paper, "Curaçao, A Losing Colonial Venture" published in the *Bulletin of the American Geographical Society* (Vol. 41, 1909).

Dr. Kindle is paleontologist in charge of invertebrate paleontology, Geological Survey of Canada. Previously to this appointment he was associated with the Geological Survey of the United States as geologist and paleontologist. Dr. Kindle has recently carried out investigations in the Mackenzie River Basin, an outcome of which is the present paper.

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PUBLICATIONS OF THE AMERICAN GEOGRAPHICAL SOCIETY

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Map of Eastern Labrador, by MRS. LEONIDAS HUBBARD, JR. 1:1,584,000. 1906. Embodies original survey of the George and Nascaupee Rivers across eastern Labrador from Ungava Bay to the Atlantic.

Map of the Catskill Mountains. 1:190,080 (3 miles to 1 inch). 1907. Generalized from the topographic sheets of the U. S. Geological Survey.

Mercator's Map of the World, 1538. Facsimile in black-and-white, reproduced from the original in the Society's collection (only two original copies of this map are known). 1885.

THE
GEOGRAPHICAL REVIEW

VOL. X DECEMBER, 1920 No. 6

SOME TYPES OF CITIES IN TEMPERATE EUROPE

By H. J. FLEURE
University of Wales, Aberystwyth

A score of miles away the traveler in the Beauce sees the spires of Chartres rising from the plain, commanding the monotonous levels of this "ancient land of harvests." On closer approach the dominance of the church of the two spires is still more closely felt. For centuries Chartres has retained its original character as an agricultural market town: it has suffered little from the obscuring effects of industrialization. In the old houses clustered round the cathedral, in the markets under its shadow, in the narrow streets leading therefrom the feeling of that protective power, the medieval church, is still present.

Thus clearly and impressively Chartres presents that physiognomy of a city type characteristic of temperate western Europe. It is of this type that the present study attempts an analysis.[1] The distinctiveness of the type may perhaps be the better appreciated by a preliminary contrast with a city type of southern France.

It has often been said that the contrasts between southern and northern France, between the Roman and the Frankish country, between the Midi and the Paris Basin are very profound. In the south many important towns go back to Roman origins. In the centuries after the fall of the Roman Empire civic life was at a low ebb; yet it survived, however impoverished, and the regrowth of the town later on, usually in the earlier Middle Ages, owed something no doubt to the remains of antiquity.

THE ROMAN TRADITION IN SOUTHERN FRANCE

The Place du Forum of Arles, the Place du Capitole at Toulouse, the square with the perfect Maison Carrée at Nîmes are the centers of their

---

[1] Valuable historical studies of town planning have been made by many writers, and the results of several have been made available for the general reader in such books as: F. J. Haverfield's "Ancient Town Planning" (Clarendon Press, Oxford, 1913) and T. F. Tout's "Mediaeval Town Planning" (Longmans, Green & Co., London, 1917.)

The present essay in no way attempts to touch upon that field or to criticize the views of those authors; it aims rather to make an estimate of the characteristics of cities which have grown up bit by bit, using for this purpose some cities of temperate Europe.

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respective towns, and subsidiary centers are made by the remains of amphitheater and theater so that the town map has something of the appearance of a polyaster. The subsidiary streets may be tortuous, and the polyaster may be influenced by fairly late reorganizations; but the type is characteristic none the less, though with modifications and complications that seem to illustrate the incoming of northern influences. The chief Christian church is not in command of the central square; it touches it in the case of Arles but only peeps in from the side, as it were. There has been continuity of urban life from Gallo-Roman days, and, when the opportunity of the medieval church arrived, it was forced in the Roman south to fit itself into the city as best it might. The cathedral of Toulouse is a poor affair, appropriately tucked away in a corner, and, though the city may well be proud of

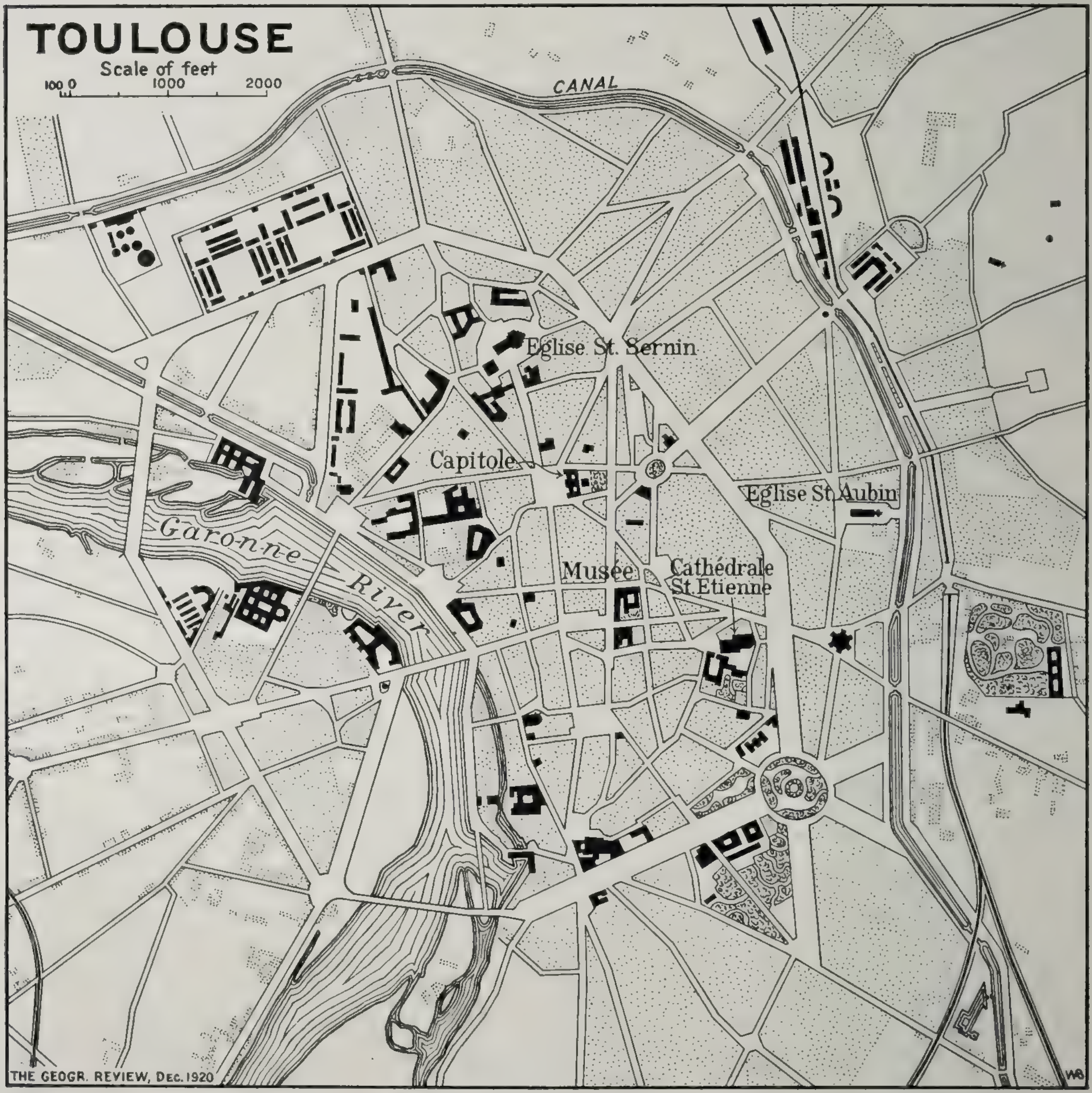

FIG. 1—Town map of Toulouse. The Capitole, or Hôtel de Ville, faces on the market place in the center of the town, while the Cathedral of St. Étienne and the fine Romanesque church of St. Sernin form subsidiary centers. The plan is typical of towns of the Roman tradition in southern France.

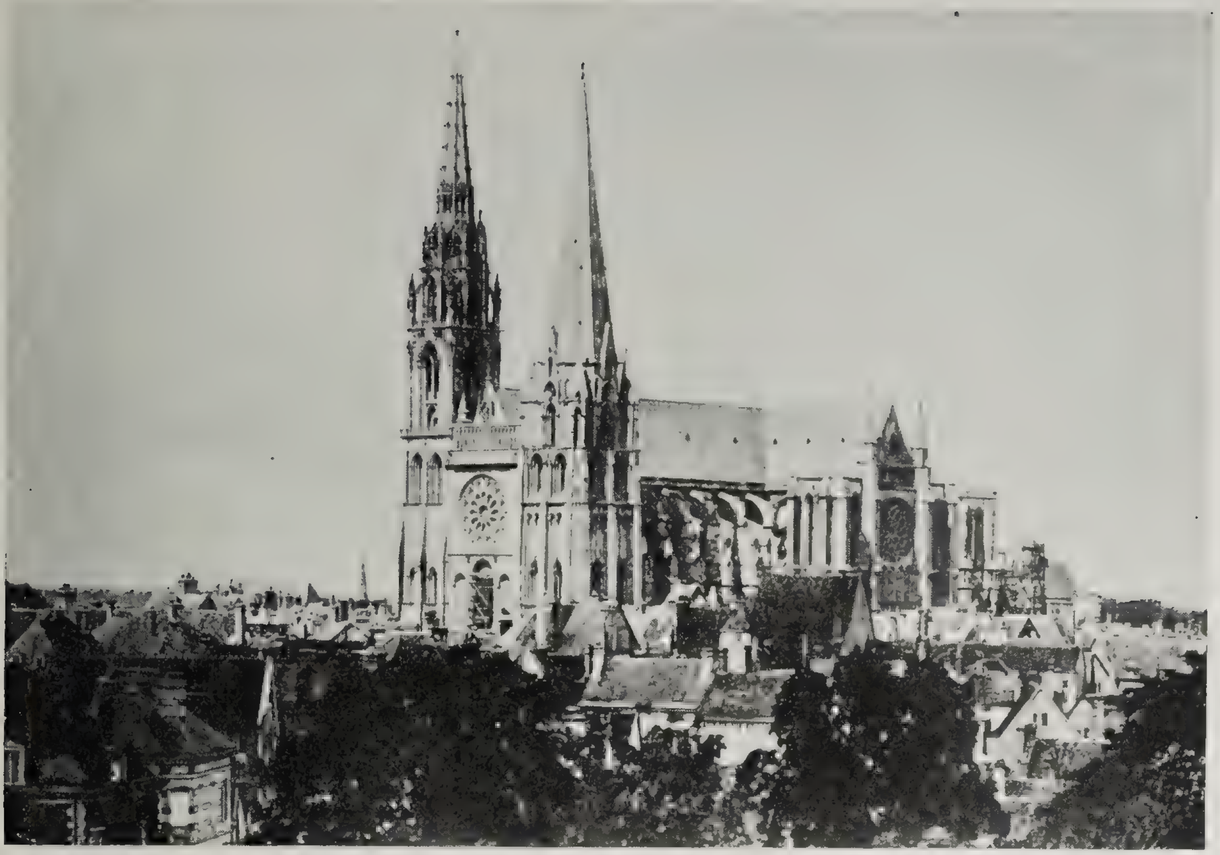

FIG. 2

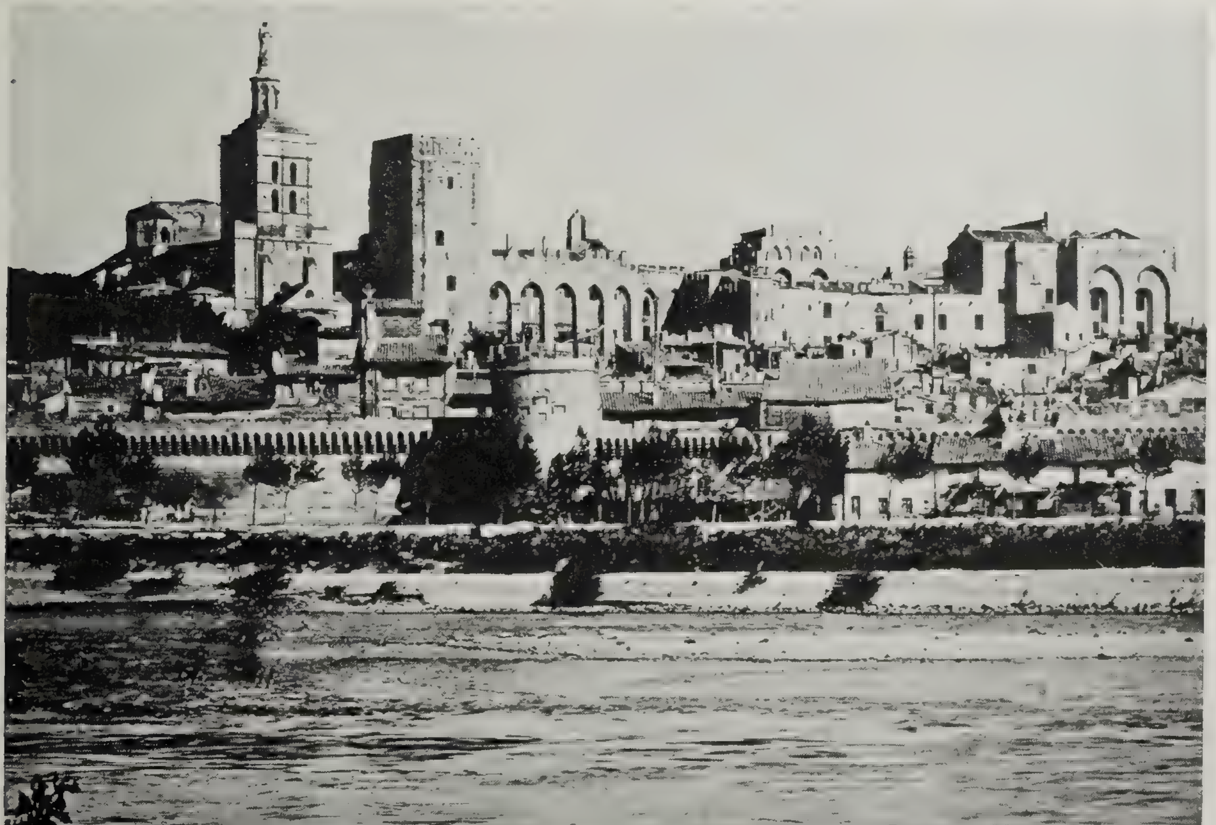

FIG. 3

FIG. 2—The Cathedral of Chartres, whose twin spires command the level stretches of the Beauce. See the map of Chartres, Fig. 4. (Copyright by Brown Brothers, New York.)

FIG. 3—The Palace of the Popes at Avignon. See the map of Avignon, Fig. 13. (Copyright by Brown Brothers, New York.)

the magnificent older and Romanesque church of St. Sernin, that great monument is on a site which forms a subsidiary center right away from the Place du Capitole.

But this is not the place to discuss the towns of the Roman tradition in southern France; the short mention of them here is merely for the purpose of emphasizing the contrast between them and the typical towns of the Paris Basin. In the Paris Basin some towns, it is true, date from Roman or even earlier times, but they nearly all owe their character almost entirely to centuries subsequent to the fall of Rome; the few exceptions there and in Britain and central Europe are mostly mentioned by Haverfield.

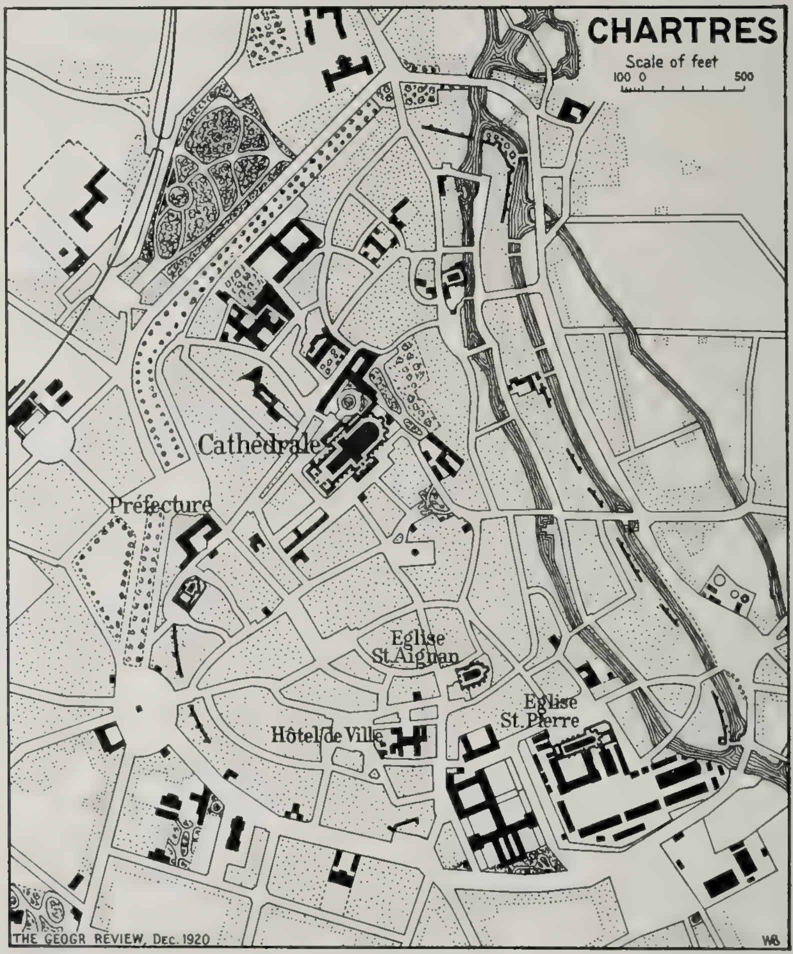

FIG. 4—Town map of Chartres. Dominance of the cathedral is typical of towns of the Paris Basin. See also Fig. 5.

THE TOWNS OF THE PARIS BASIN

In the Paris Basin the influx of Germanic and other invaders submerged the Roman tradition and the more effectively so because those invaders brought for the most part a rural, when not actually a semi-nomadic tradition that stood out in contrast to the urban heritage of Rome. In Roman western Europe the wealthier and more powerful persons lived in the towns and used the surrounding lands as sources of revenue, providing amphitheaters and other buildings in the towns as places for festival gatherings of the rural folk. In the Paris Basin it was the Frankish invader who was largely responsible for reorganization after the post-Roman chaos, and he was non-urban or even anti-urban, cultivating and improving his land and organizing it with subject cultivators, as it were, in the hope of making a self-sufficing unit. How far the manor is derived from Gallo-Roman survivals as Fustel de Coulanges will have it, or from Frankish or Saxon ideas as De Tourville argues, or from circumstances of the times which emphasized defense and militated against freedom of exchange and promoted payments in kind and in service, it is not to the point here to inquire. All are agreed that for a while the town was of small account.

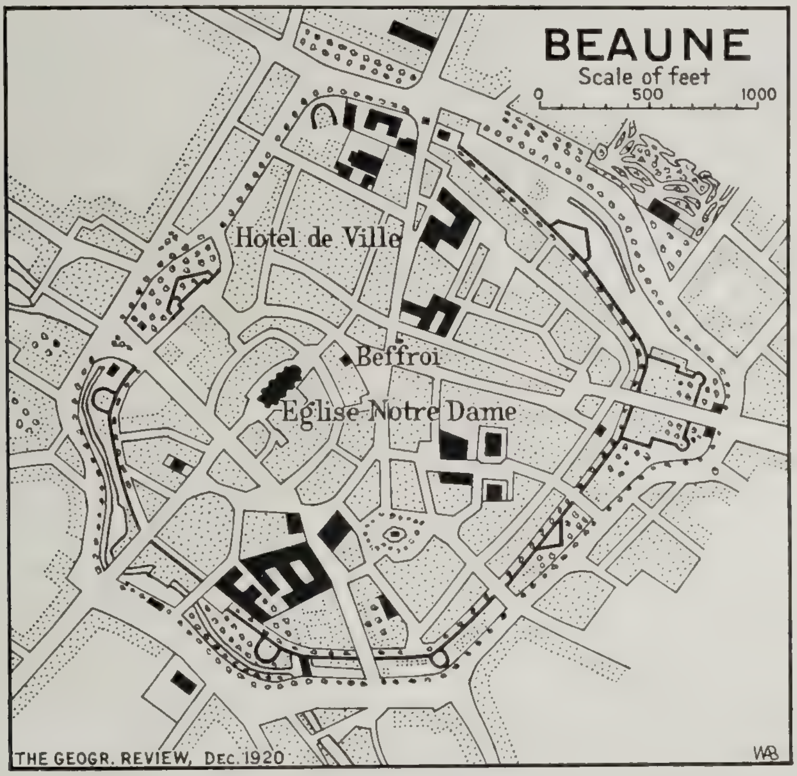

FIG. 5—Town map of Beaune.

But with the Frankish organization there went a strong effort towards forest clearing; the spread of cultivation in a corn land led inevitably to a good deal of differentiation of labor and growth of exchange. Fairs arose at several places, and markets at many more.

During the Merovingian (early Frankish) period the church won a special position attested in many ways in historic documents and based upon many facts, among which one of the chief was that churchmen were the men of learning and carried on, be it in ever so attenuated a fashion, the tradition of Roman respect for law and order.

The two complex groups of facts here merely hinted at give us the market and the church as two elements drawing men together for peace. We find the cathedral dominating the market place and the two dominating the whole town in city after city of the Paris Basin. The town is a place to

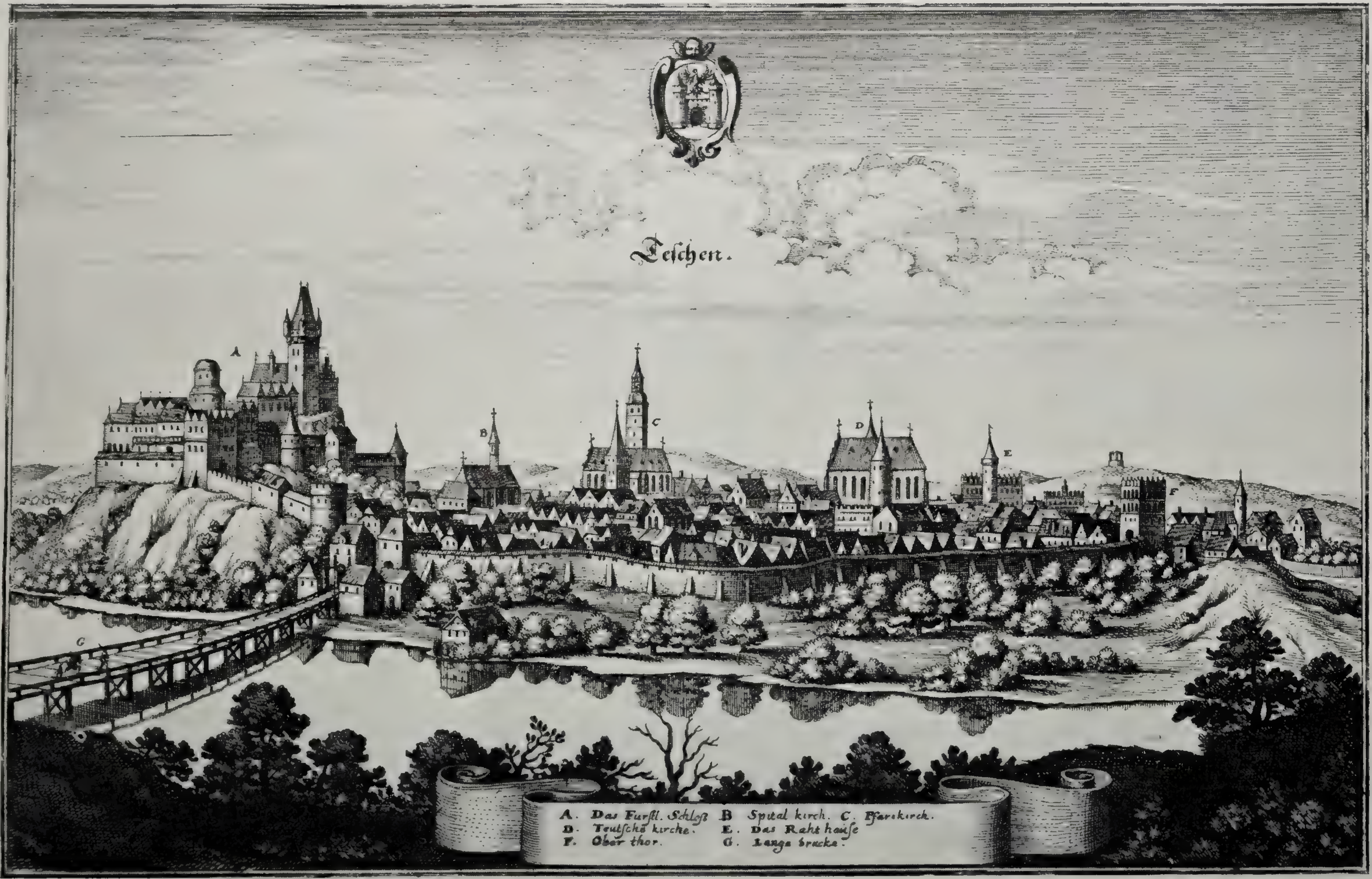
Teschen.
A
B
C
D
E
F
G
A. Das Furſtl. Schloß B Spital kirch. C. Pfarrkirch.
D. Teutſche kirche. E. Das Raht hauſe
F. Ober thor. G. Lange brucke.

FIG. 6—View of Teschen in the seventeenth century. Note the dominance of the defensive features—thick walls and massive towers, and the fortified castle typical of a town in a "zone of strife." (From Matthaeus Merian: Topographia Bohemiae, Moraviae et Silesiae, Frankfurt, 1650.)

which the rural cultivators come to market and for festivals, and both are under the protection of the church. The church had prepared for its work by its long missionary effort on the Central Plateau where little towns cluster around a little church of hoary age.

With the growth of cultivation went increased diversity of occupation, especially in a region of mixed stock raising and corn growing, and the industrial workers gathered in the growing town in groups, occupying winding streets leading towards the market place. Many of them needed water, either for power or for the processes of industry, and the town needed water for its life; and moreover a bend of the river, especially in dissected plateau areas, offers a site for a town with reasonable facilities for defense and often a dignified position for the dominant church. We thus frequently find a town on a definite site either in the bend of a river or between a tributary and the main stream, or near a river on a hill spur that has somehow been partly isolated. Defense is important, and the walls and the castle, the river and its bridges are important features; but it is the church and the market that dominate the town.

As the town arose to meet the local needs in an area which was trying to be self-sufficient, under conditions spreading with only minor variations over the Paris Basin, it is naturally the case that the cities of the basin have a considerable likeness one to another. They are also fairly closely set, as we can well understand if we think of the difficulties of early transport and of the needs arising from the variations of stock raising and corn growing. There are some areas, however, like the plateau of La Beauce, where problems of water supply hindered town growth save in a few spots, or like the marshes of La Sologne, where towns cannot grow at all. The tortuous streets reveal the gradual growth of the town without the Roman resources and power of expression, but it may be doubted whether the crowding we associate with the old parts of the towns is always an original feature. It is probably such in some cases, but the towns are gathering places of an originally rural population, and we know from the plan of Roman Silchester and the lay-out of medieval Salisbury that rural folk coming into town wanted space for gardens.

The Cathedral the Center of Civic Life

Each craft often had its own street representing a group of workers with much co-operation in their workaday life, and the co-operation between the crafts in the life of the town as a whole centers around the church, frequently a cathedral with a bishop. The bishop was often of old a local leader rather than a part of the central organization, as he tended to be in nineteenth-century England. There would be a hospice in the town, and in many cases a great feature would be a Benedictine Abbey just outside the town, an agricultural college as well as a religious brotherhood. But the cathedral expressed the town life most of all, however important the walls and the castle might be. It was much more than a place for religious offices; the nave was used by the citizens for many purposes, and it is interesting to see French market women still coming into the church, baskets and all. The unity of the town centering in the cathedral is the leading feature in the Paris Basin. This point is emphasized here in order to enable us to follow modifications in other regions.

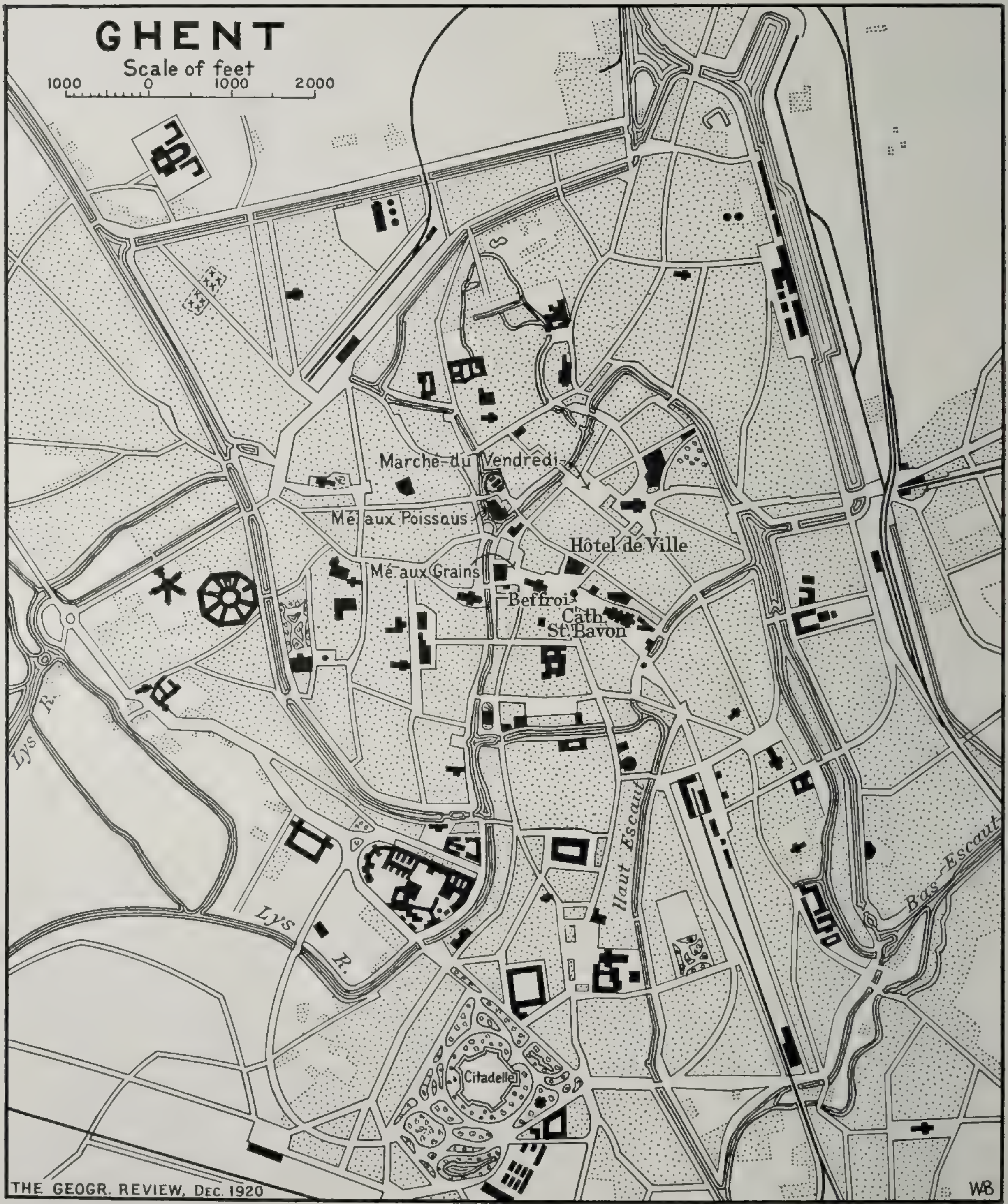

FIG. 7—Town map of Ghent. The commercial interests of Ghent are evidenced by the various markets, the largest of which, the Marché du Vendredi, was the center of the life of the medieval city, and the guild halls, the finest of which is the Maison des Francs Bateliers on the western side of the Marché aux Grains.

The larger market towns were centers to which, in the later Middle Ages, came the wealthier folk, by that time using the land for its amenities in hunting, etc., and as a source or revenue rather than a sphere of work. They built *hôtels*, i. e. mansions, some of which have become hotels in the modern sense, but it is characteristic of the Paris Basin that several have become museums and picture galleries, often of considerable local interest.

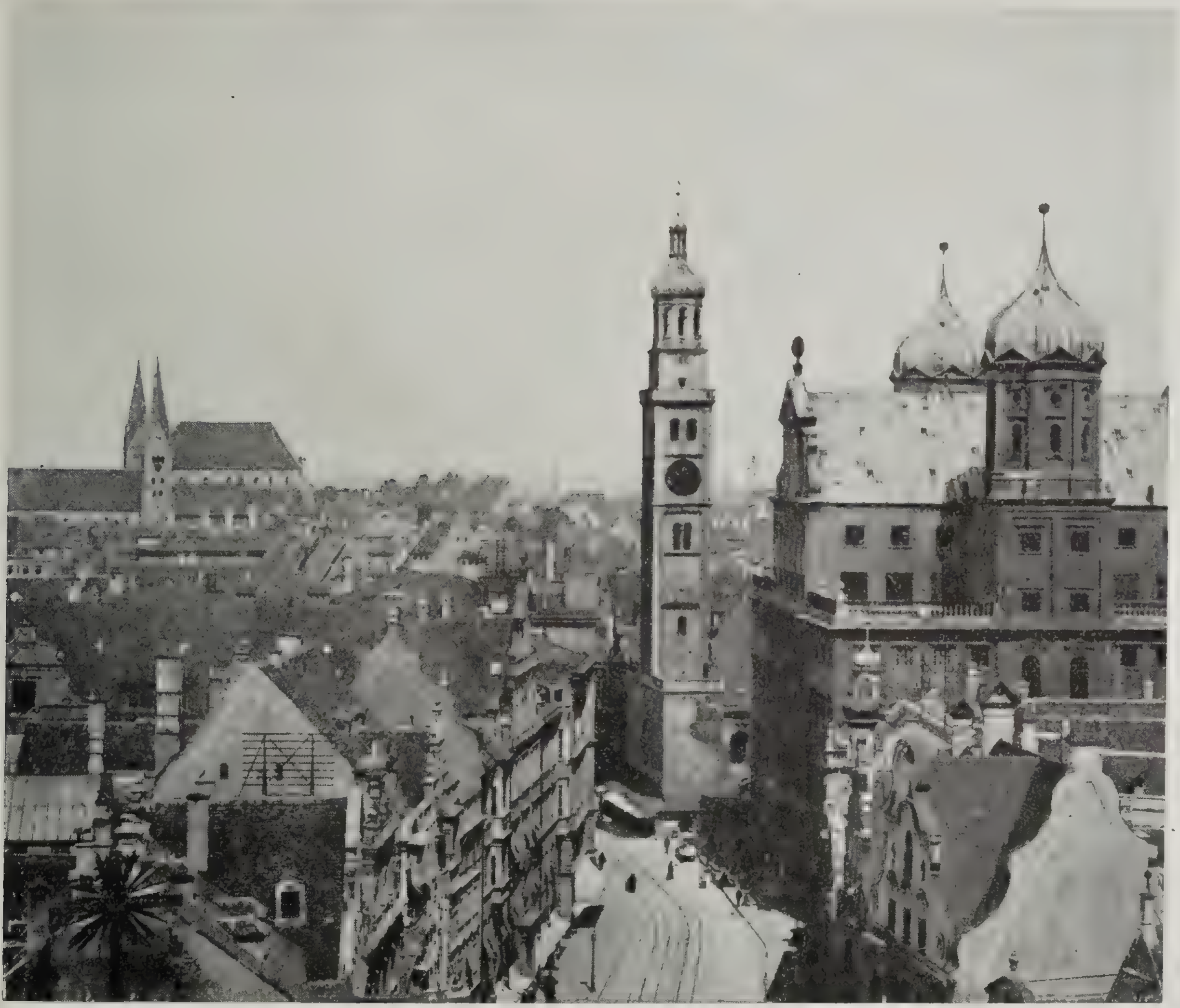

FIG. 8—View of Augsburg. The Karolinenstrasse, showing the old watch-tower and the town hall, with the towers of the cathedral in the background. (Copyright by Underwood & Underwood, New York.)

We are dealing with a country that has kept its peasantry, that has gone through many political revolutions, it is true, but has maintained a greater social continuity among the simpler folk than England has. The relation of this continuity to the broad distribution of a certain untutored taste is an interesting line of inquiry.

The decay of the abbeys has, unfortunately, transformed their neighborhood too often into a rather depressing quarter; but one can think of several cases in which that quarter is noted for hay and corn stores, stables, farriers, cart makers and menders, and small inns galore.

The variants within the Paris Basin and its borders include old towns like Caudebec-en-Caux, using for industry the water power of streams gushing from beneath the chalk scarp, or like Falaise where the castle is unusually dominant.

Towns of the Alemannic and Flemish Borders

An interesting addition to the equipment of the town, or perhaps rather an instance of differentiation of function, appears as we leave the Île-de-France and proceed either towards the Flemish or the Alemannic borders.

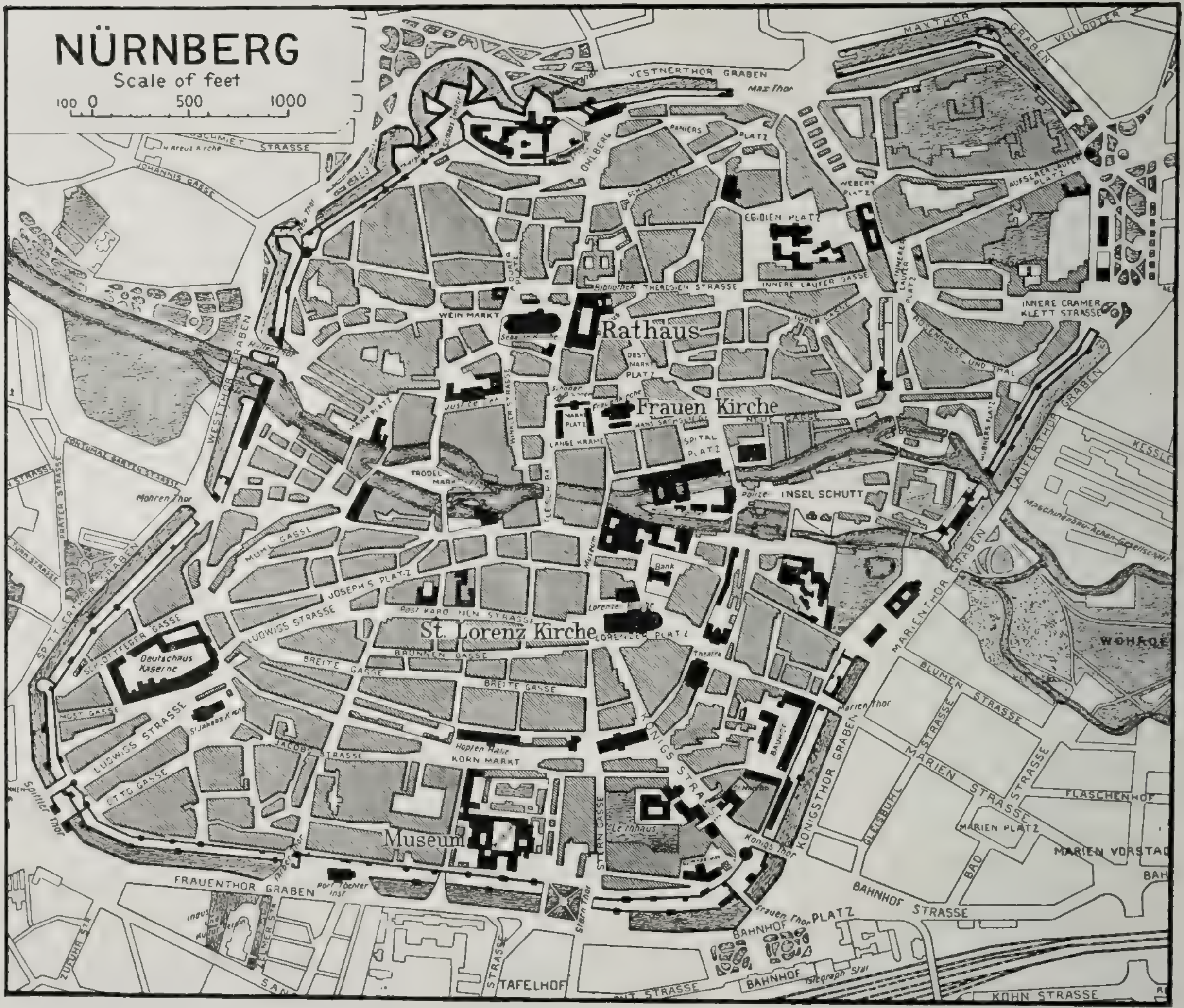

FIG. 9—Town map of Nürnberg. The city of Nürnberg retains to a remarkable degree the aspect of a medieval Bürgerstadt. (From "The Story of Nuremberg," by Cecil Headlam. Reproduced by courtesy of J. M. Dent & Sons, Ltd., London, and E. P. Dutton & Co., New York.)

A *hôtel de ville* of medieval, though not early medieval, date becomes characteristic, and either on it or over a gate in the city wall stands a *beffroi*. With increasing distance from the central power the bourgeois life expressed itself more sturdily, and the preoccupation of the princes with war helped the citizens to gain their rights, but the *beffroi* also betokens the approach to the historic war zone and the need of the citizens to gather for their own defense against invaders seeking to penetrate into the good lands of the basin.

As we proceed further the dates of social evolutionary processes grow later, religious and secular become increasingly differentiated, and guild halls of the crafts appear; they are notable, for example, in Flemish and Walloon cities. One may also recall in passing the conflicts of bourgeois and bishops in Geneva and the triumph of the former expressed in the subsequent story of the city of Calvin and Rousseau.

The Germanic Cities

Needless to say, the variety of local circumstance and initiative led to much variation in the form of differentiation of social expression, and it is rather more difficult to see detailed community of type in the cities of the more Germanic lands. The cathedral is less dominant, the castle on the whole more so. The guild houses of the crafts in many cases are very notable additional features. *Bürger Deutschtum* and *Junker Deutschtum* show their conflict in the country's town maps, and we have to take account of the fact that the architecture we call Gothic was a creation of the Paris Basin and penetrated into Germany under the influence of ruling classes rather than as a popular movement. This helps us to understand the lessening of church dominance in the town map and the rarity of good Gothic architecture in Germany.

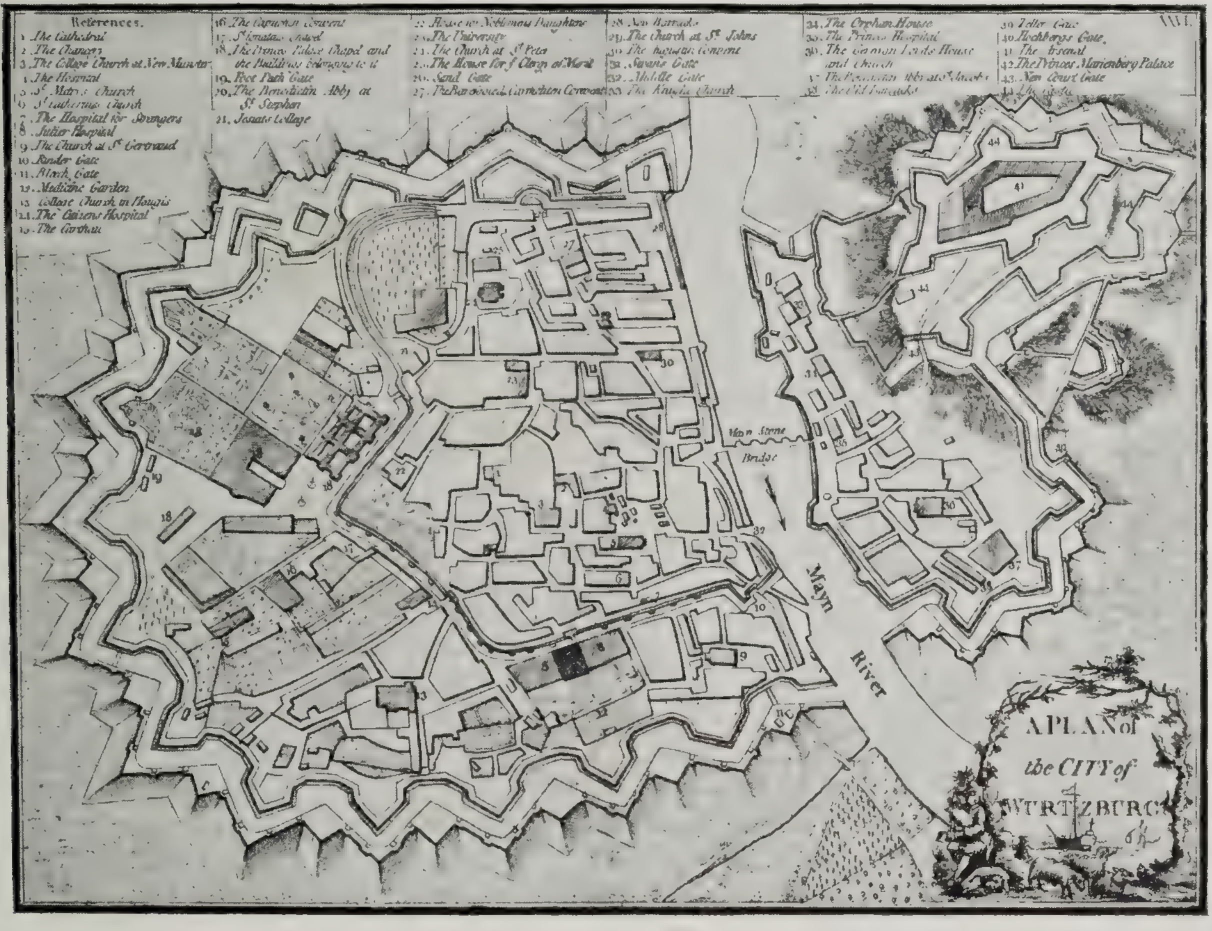

Fig. 10—Town plan of Würzburg. The Cathedral occupies a central location (1) but the whole city is dominated by the fortified castle of Marienberg on the left bank of the river (44). The University of Würzburg (23) still preserves much of the tradition of the medieval academic life. (From John Andrews: A collection of Plans of the most Capital Cities . . . . ., London, 1772.

A marked difference between South Germany and the Paris Basin arises from the fact that South Germany has no such dominant center as Paris and also from the fact that much more of the substance of educated thought is an importation through the agency of rulers and leaders. The University of Paris, with its romantic growth and its relation to the church and people, is unique. Other universities of the basin did not attain much strength, Paris dominating too directly. In South Germany the universities are numerous in ever so many of the sub-centers of that diversified region, and they sometimes dominate the city. They are all universities of the Paris type, i. e. groups of teachers with pupils gathered around them, not of the southern type which is fundamentally a student democracy. The physical diversification, again, in delaying political unification allowed to a far greater extent than in France the specialization of cities as fair centers with a large measure of independence, and these cities with their market places and their houses of merchant princes are a well-known feature. The cities of Ghent and Augsburg come to one's mind here.

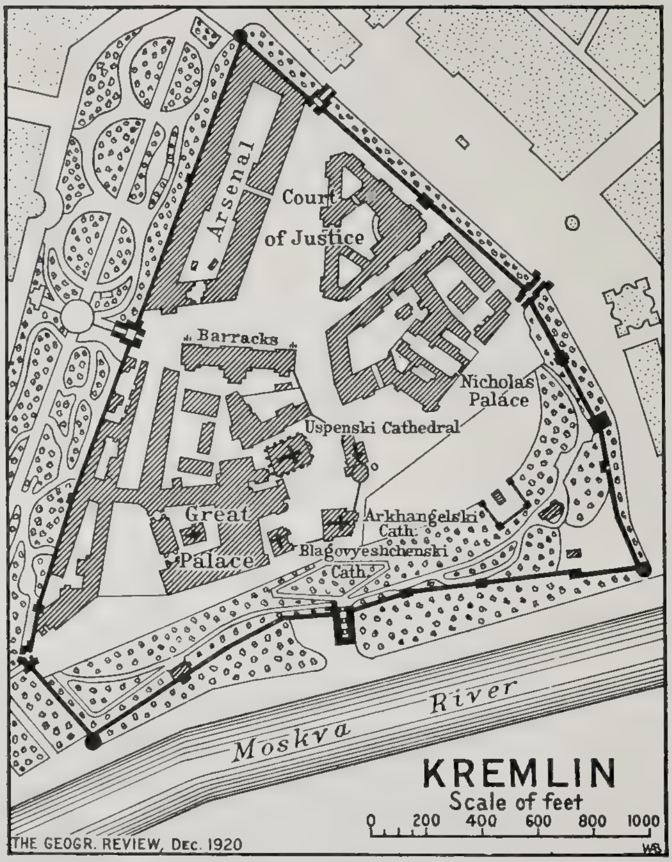

FIG. 11—The Kremlin. "The Chiefs' Town" of Moscow contains the palaces of the rulers, the cathedral of the orthodox church, the court of justice, and the arsenal.

We must not, however, push our working hypothesis too far. Not all the features of a Germanic city are to be looked upon as derived by a process of importation from the Paris Basin accompanied by various types of differentiation. That hypothesis helps us in some measure, but we cannot live in Zurich, for example, without realizing that there are also products of the thought and tradition of the local inhabitants, both Alpine and Nordic. The cities of *Bürger Deutschtum* deserve our keen appreciation, even when their churches seem strange and cold in comparison with those of France. They are cities built for the citizens' life, and the seeking of private profit has not that unique prominence which makes modern English industrial cities, and some others too, such a sad commentary on western civilization. A striking feature is that many of the German cities in spite of their immense growth in the industrial and financial periods have still kept their old character. The city fathers were wise enough not to let the municipal lands get into private hands, and so the industrial growth has in many cases been on public land, and the amenities of life have received some consideration. Slums do not seem inevitable, railways and docks have been placed with some regard to the public interest. Theater and concert hall are supported by the city and are able to provide opportunities for musical talent and for the citizens' healthful enjoyment that are often matter for envy. Governmental regulation in the past half-century seriously lessened the good derived from all this, but, if that source of danger is now really removed, the *Bürgerstadt* may once more become a great contributor to our common civilization.

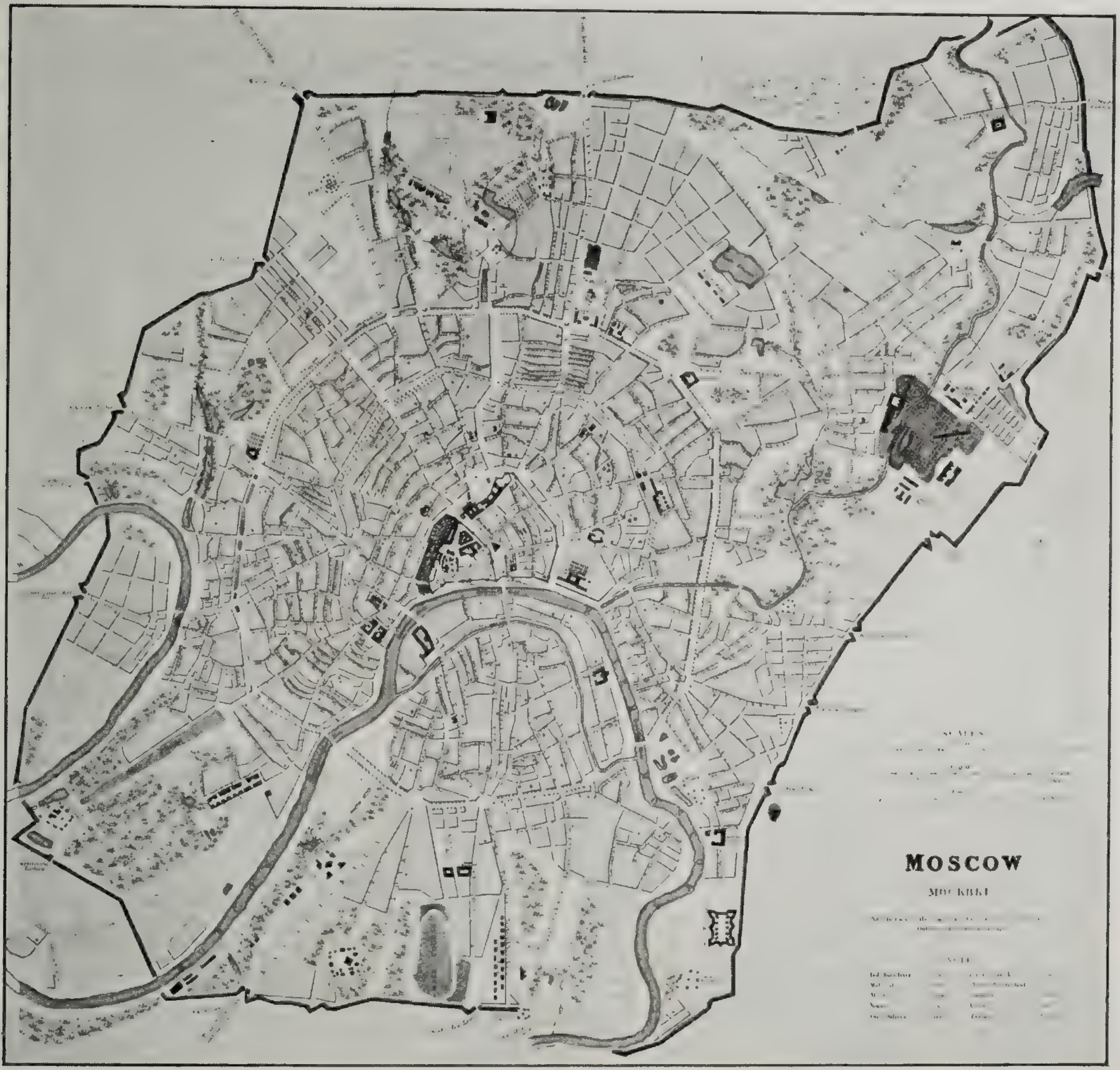

FIG. 12—Town map of Moscow, 1839. The plan clearly shows the distinction drawn between the rulers and the people. A broad open space for intercourse and exchange separates the Kremlin from the people's city. Compare view of Moscow, *Geogr. Rev.*, Vol. 1, 1916, p. 259.

CITIES OF EASTERN EUROPE

Further east the general type of city tends to change again. Importations from the west by rulers and leaders stand out still more distinctly.

At Prague, for example, on one side of the river we have the fortress, with the palace and the cathedral within it, standing out over against mercantile Prague on the other bank, with its *Rathhaus* and its *Tynkirche.* The *Junkerstadt* and the *Bürgerstadt* are distinct, though both are German to a considerable degree.

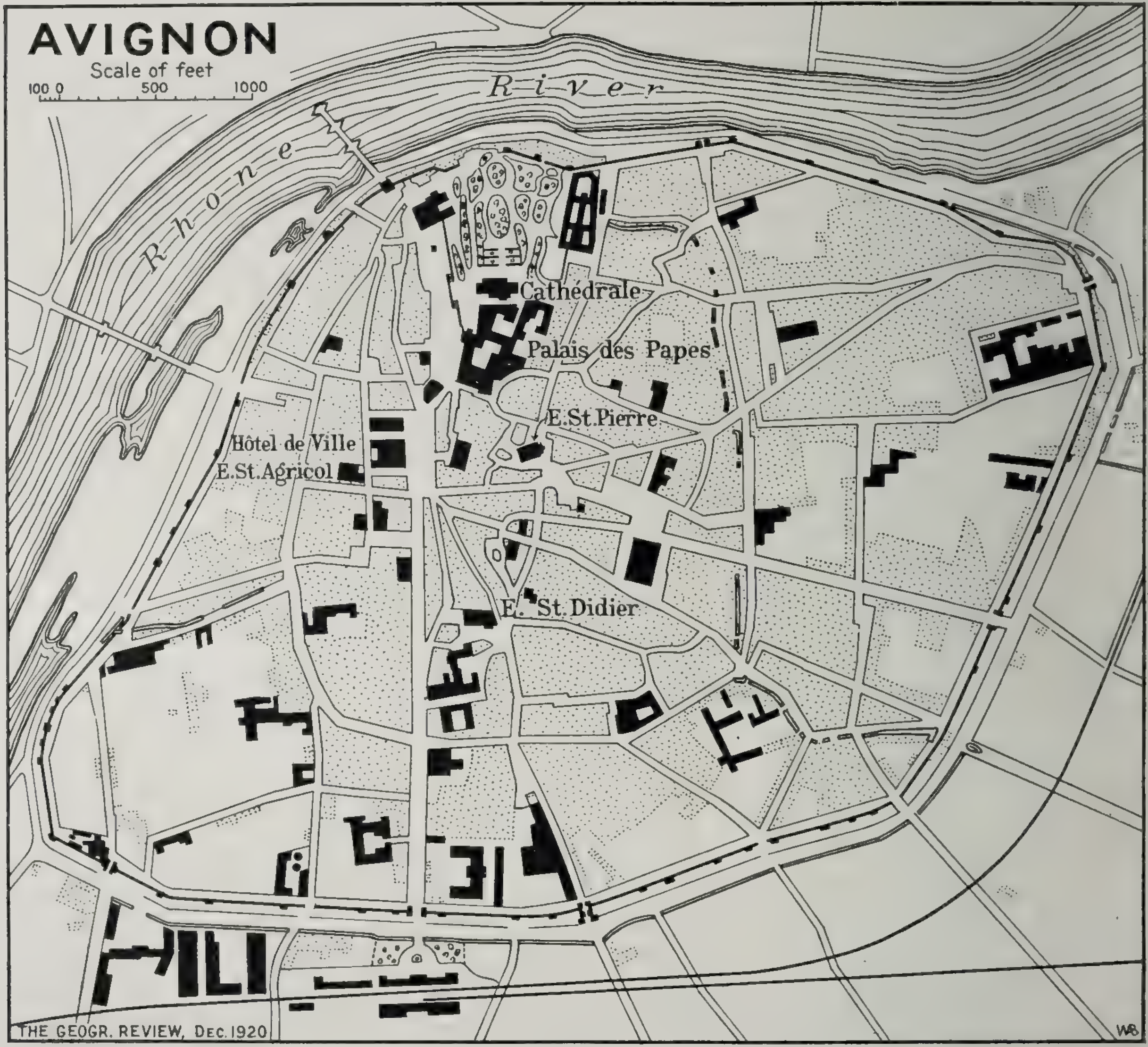

FIG. 13—Town map of Avignon. The Palace of the Popes (see Fig. 3), overlooking the town and its suburbs, marks the domination of a foreign power.

Eastward, again, the element of importation is still stronger and has become dominant. The Russian Slavs look upon themselves as colonists in clearings of the forest—colonists who have come from the Galician platform in the course of centuries. They are only semi-settled, and their share in the civic life is only a secondary one. The towns grew around the settlements of Varangian chiefs and Hanseatic traders with the help of religious permeation northward from Byzantium through Kiev. The center of the city, whether at Moscow or Novgorod, is the *kremlin.* It corresponds in a sense to the Hradschin at Prague, but here it occupies the heart of the city which radiates around it in every direction. Here, also, we have no rival center with *Rathhaus* and *Tynkirche.* The Kremlin at Moscow includes three great cathedrals, eighteen other churches, and also palaces and fortifications. It is literally a chiefs' town; and outside its crenelated walls were planned open spaces for intercourse and exchange, and some churches and other buildings of the people's city have grown there. Beyond them the people's city radiates in all directions. At Moscow it is easy to see how the religious spirit of the Russian peasantry has sanctified the commonplace by building the innumerable churches of the Mother City, but at its center is the strange combination of Varangian and Byzantine with who knows what strange touches of the mystery of the East.

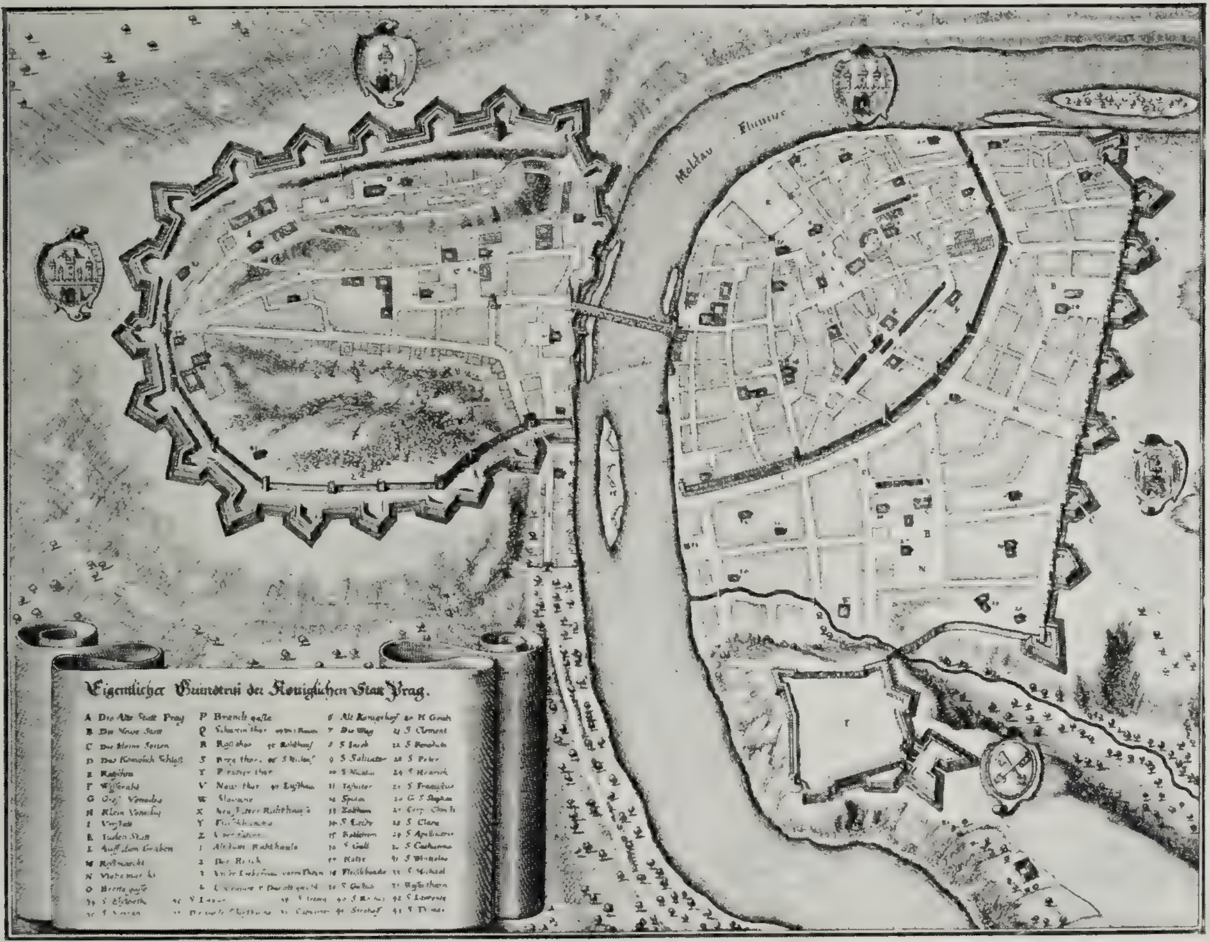

Fig. 14—Town plan of Prague. The Old Town and the New Town, on the right bank of the Moldau, form the mercantile center of the city, with its markets, (2, N and M), its town-halls, (1 and X), and the Jews' quarter (K). On the left bank stands the Hradschin, the fortified residence of the Bohemian kings, with its barracks and cathedral. (From Matthaeus Merian: Topographia Bohemiae, Moraviae et Silesiae, Frankfurt, 1650.)

Avignon Compared with Moscow

One famous French city presents the most interesting analogies to Moscow. It is Avignon, the city of the popes. Avignon has its southern market place and its scores of other characteristics of an ordinary city of the south, but it is completely dominated by the grim palace of the popes, and within the *enceinte* of that palace the cathedral also finds its place. Outside its ramparts is an open space marking off this monument of a temporary foreign domination from the rest of the city. In other words, there is the brusque juxtaposition of foreign and indigenous organizations in Avignon somewhat as there is in Moscow. No one who knows France will need to be told how Avignon stands apart from other French cities in character.

SUMMARY

The surface of temperate Europe, from the shores of the North Sea and the English Channel on the west to the southern part of the Urals on the east, was covered by deciduous forest before man cleared it. The summer westerlies bring rain that keeps this vegetation healthy, and the soil is warm enough to allow the roots to act freely and draw up the abundant moisture given off by the spreading leaves. The leaves are dropped as the winter cold sets in. The régime which favors the deciduous forest also favors, or at least permits, corn cultivation. Permanent settlement is possible where the growth of one season of the year provides the main part of the food for the twelve months. To the north, where the soil is colder and the roots may not work so freely, only the pines, much more economical in their demands for water, can grow. The soil of the pine forest yields very meager return to the cultivator, and so the belt of the deciduous forest is, broadly, the northern belt of cultivation in Europe.

FIG. 15—The Castle and Cathedral of Cracow. (Photograph copyright by Brown Brothers, New York.)

The Paris Basin was the first of the regions of the deciduous forest to be extensively cleared, and in the post-Roman centuries forest clearing was proceeding here and spreading eastwards generation by generation. It affected many parts of Germany in the seventh to the ninth centuries and continued later in Bohemia and Poland and later still in Russia, where the forest is of oak without the more exacting beech for a companion. Forest clearing led to improved conditions for settled life, and settlement became well defined in the Paris Basin while as yet the Germanic lands were in the wild. The progress of settled life eastwards has been a most noteworthy feature of European history and of late has been affecting Russia in an increasing measure with corresponding increase of difficulties in the matter of land ownership.

Settlements were at first largely rural. Cultivators of wheat sought supplies of salt as an accompaniment of a cereal diet and necessarily of a winter diet that included pork. Urban centers grew up in course of time as a necessary consequence. Just as in earlier efforts so here the Paris Basin led, and the cities of that basin mark the blossoming of settled life after the centuries of post-Roman movements. On the whole, city development becomes later as we go eastwards. Again Prague and Warsaw in the center of riverine regions are younger than Domazlice and Cracow in the gates of the hills. Both Prague and Warsaw are known to have been founded in forest clearings and to have replaced the older cities in leadership of their respective regions.

With extension of settled life and urban life went the eastward extension of the Roman Church in its medieval form, heralded by St. Augustine's famous discussion of the City of God. The chain of thought he encouraged contributed its quota to the character of the city as it arose in the early Middle Ages in the Paris Basin with the cathedral as in a large measure a synthesis of its common life. But time brings definition, and definition brings differentiation of function with the inevitable consequence of differentiation of structure. So we get *hôtel de ville* or *Rathhaus* side by side with the cathedral on the eastward and northeastward road, and guild halls of the crafts show us a further stage of the process. Moreover, the multitude of smaller and more local causes included under the name of chance make the differentiation take divers forms in divers cities of the Germanic lands. Add to this also the undoubted direct influence of the *genius loci.*

Thence we pass on to the regions where western ways were introduced by the leading classes, and with this we find the differentiation of a leader city with palace and cathedral within its ramparts. Naturally we find this especially after crossing the formidable language barrier between the western tongues and the eastern Slavonic ones. At the same time other factors, factors arising from the life and thoughts of the native population, affect the more easterly cities; and nowhere are they more evident than in Moscow consecrated by the gift of generations of Russian pilgrims to its ever increasing number of shrines.

Finally we may notice the cities of the steppe border in Russia founded as the authority of settled life and its form of government spread and pushed the nomadic life back again towards the east during the recent comparatively wet climatic phase. They were founded where land was abundant by ambitious leaders commanding considerable experience and resources. They show the rectangular plan typical of civilized effort not only in modern Russia and the New World but also in the ancient Mediterranean region and Mesopotamia and apparently the ancient Orient as well. Abundance of land has meant over wide streets in Russia, just as costliness of privately owned land has meant disastrous overcrowding in industrial cities in England and elsewhere. To trace the extension of civic expression from France to Britain would be at least as interesting as to trace it eastward through the deciduous forest but other factors have been at work with their modifying effect.

The study of the city map, we may now conclude, stimulates many thoughts about the progress of humanity, about that complex interweaving of environmental influence and cumulative human effort through the centuries which it is a special function of the geographer to try to interpret.

THE BLACK BELT OF ALABAMA

By Herdman F. Cleland
Williams College

To speak of the "Old South" is at once to suggest a very definite type of civilization. There has been no more distinctive human product of American soil than the culture of the "Cotton Kingdom" of *ante bellum* days. Two generations from the declaration of democratic faith saw flourishing a caste system, rooted in the institution of slavery of which the spread was largely conditioned by geographic factors—the fertile soils and warm temperate climate of the South.[1]

It was a short-lived civilization this, with its social ideals expressed in the ownership of "a mansion, a cotton plantation, and a hundred slaves,"[2] but its relics still remain. If one would see them before they are swept away by the hand of progress let him for choice go to Alabama and in Alabama to the Black Belt. Ask almost any Alabaman where the best *ante bellum* architecture of the state is to be found and the answer will surely be, "In the Black Belt." Ask in what part of the State the people are most cultured and most highly educated; where the traditions and prejudices of the Old South are strongest, and it will be, "In the Black Belt." Ask for a town typical of the Old South, and Greensboro will frequently be mentioned; and unspoiled, Greensboro is well worth a visit.

A Typical Black Belt Town

A brief description of this town of about 2,000 inhabitants, of which the greater portion are negroes, will serve as a starting place from which to discuss the geographic influences which shaped the civilization of this interesting region. Moreover, Greensboro is especially favorable for such a study because, like most towns of the Black Belt, it is not situated on a waterway, and the complex factors which arise from such a situation are lacking.

The "Mansion" of the Cotton Planter

About a mile from the railroad station at a turn in the road is seen the first "mansion" or "big house," as the negroes term the home of the landowner, whether it be large or small. It is almost hidden by a tangle of vines and shrubbery and by the great trees which shade it. A more perfect setting for the most romantic stories of Thomas Nelson Page would be hard to find. The dignified simplicity of the tall Ionic columns that support the pediment to form the porch, the nearly perfect proportions of the house gleaming among the green of the great oaks give an impression of culture and romance.

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[1] F. V. Emerson: Geographic Influences in American Slavery, *Bull. Amer. Geogr. Soc.*, Vol. 43, 1911, pp. 13–26, 106–118, 170–181.

[2] W. E. Dodd: The Cotton Kingdom; A Chronicle of the Old South (*The Chronicles of America Series*, Vol. 27), Yale Univ. Press, New Haven, 1919.

Further on down the street other *ante bellum* houses are seen, all in spacious grounds, but most of them surrounded by unkept lawns and decrepit fences. No two houses are alike; each has its own individuality, and most of them have great charm. In all of them the columns are two stories high; but some are square, some round and smooth, some round and fluted, some hexagonal, some thick, and some slender. All the houses have either a gallery running their full width or a balcony over the front door. Some, however, are not of the colonial type but show the influence of the French architecture so characteristic of old New Orleans. As a rule, a wide hall, with a high ceiling, extends through each house on each side of which are two rooms 20 by 20 feet. In *ante bellum* times the kitchen was entirely separate from the main building; but this custom was abandoned after the freeing of the slaves, and the kitchens are now attached to the houses.

In construction and appurtenances the mansion is typical of the civilization that produced it. In a town of the Black Belt not far from Greensboro is a house perhaps as large and fine as any in this town—a house which cost the owner, according to his boast, not more than $450. The bricks for the foundation and fireplaces were made and laid by his own slaves; the lumber came from the trees of his own woodland and was cut and sawn by his slaves; and the house was built by negro carpenters who belonged to him. Only the window glass and hardware, which his blacks could not make, were purchased. It is difficult to estimate the cost of the *ante bellum* houses, which were built largely by slave labor, because of the great variation in the cost of interior decorations. From the data available it seems probable that a house worth $25,000, if built by contract in 1914, probably cost about $3,000 or $4,000 under *ante bellum* conditions.

The Poorer Quarters and Negro Cabins

There is an erroneous impression in the North, and in the South for that matter, that most of the white population of the South before the Civil War were slave owners, whereas the truth is that only about 40 per cent of the families owned slaves. The poor of the white population did not own slaves, and their houses were as cheap and unsightly as those of people in similar circumstances today. Consequently any one who visits Greensboro expecting to find a street lined with stately dwellings will be greatly disappointed, for there are more unattractive than attractive houses. Nevertheless the proportion of old dignified houses is sufficiently large to make the streets unusually interesting, and is greater perhaps than in any other town in the South. The fact that the "mansions" were surrounded by extensive grounds should not be forgotten if a true conception of a Black

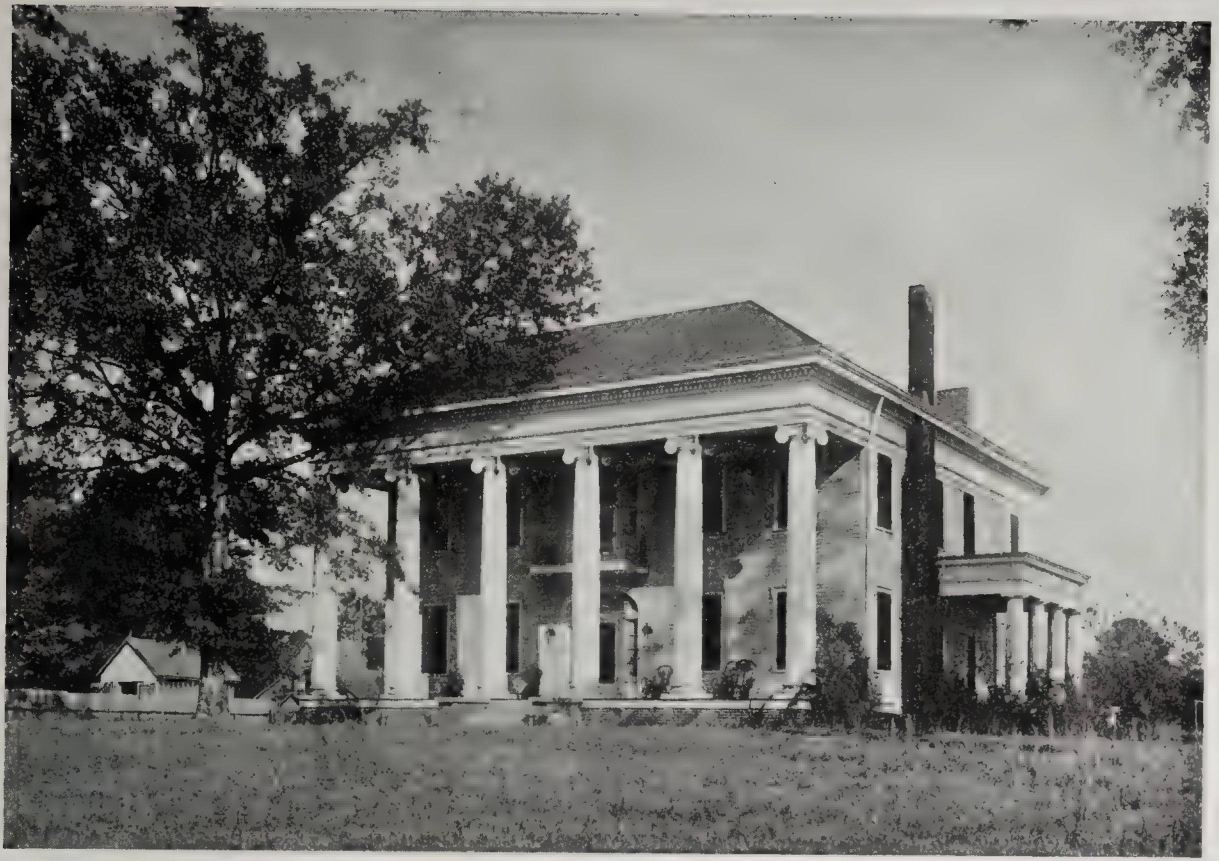

FIG. 1

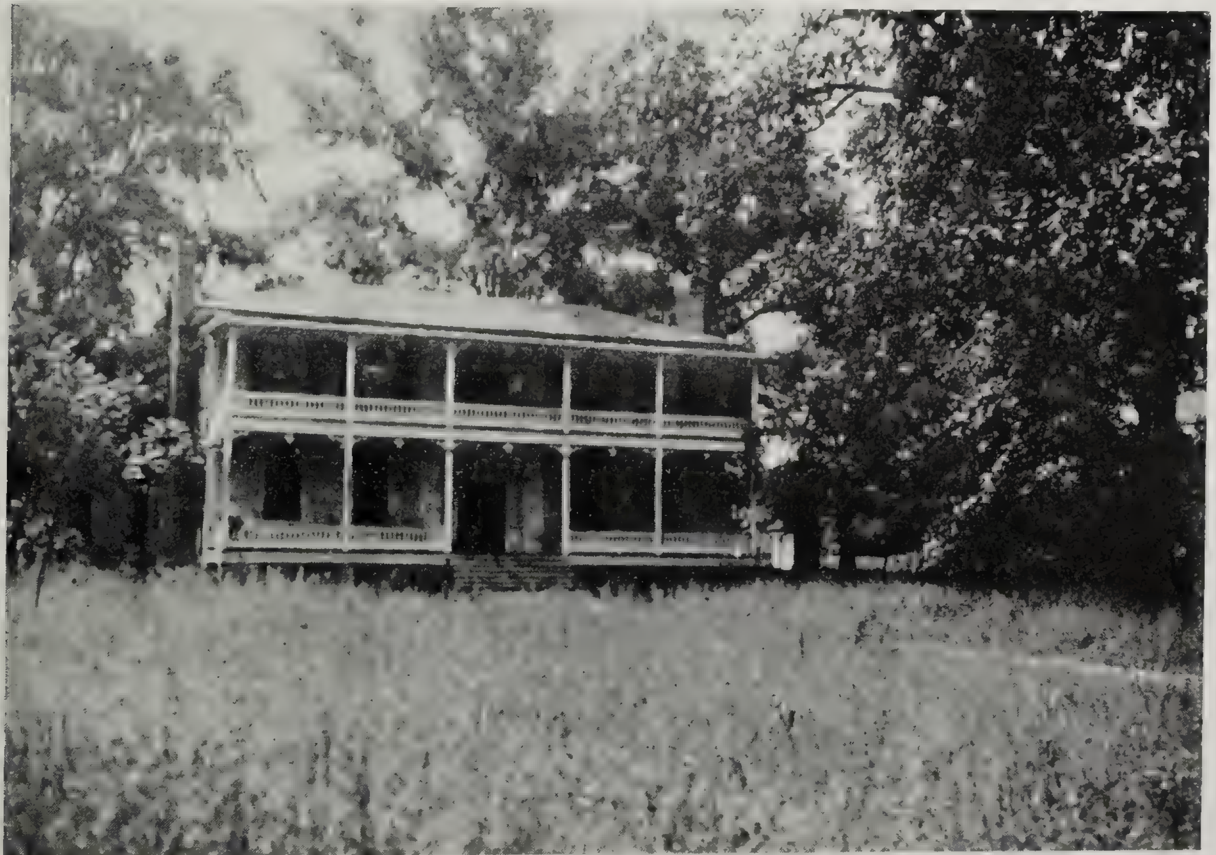

FIG. 2

FIG. 1—This mansion was built in 1852 by the owner of a plantation of 1,500 acres. The house is no longer in possession of his descendants although they retain the land.

FIG. 2—A number of Black Belt mansions show the influence of the French architecture so characteristic of the older houses of New Orleans. This house was built in 1843 by the owner of a plantation of 1,800 acres.

Belt town is to be gained. The following figures, taken at random, are the areas of the plots of ground surrounding the planters' homes in Greensboro: 140, 60, 30, 6, and 5 acres.

The black servants of the planters lived either in a restricted section of the town or in cabins scattered here and there over the plantations. These cabins are nearly all alike, containing one or two rooms and having a brick, or stick-and-mud, chimney built on the outside. In the country districts one sees many negro cabins and occasionally an overseer's house but seldom the home of a planter. Indeed the picture that comes to one's mind after traveling over the Black Belt is that of a fertile, gently rolling prairie with negro cabins standing in the open fields and not even a tree or shrub to furnish shade or add a touch of beauty.

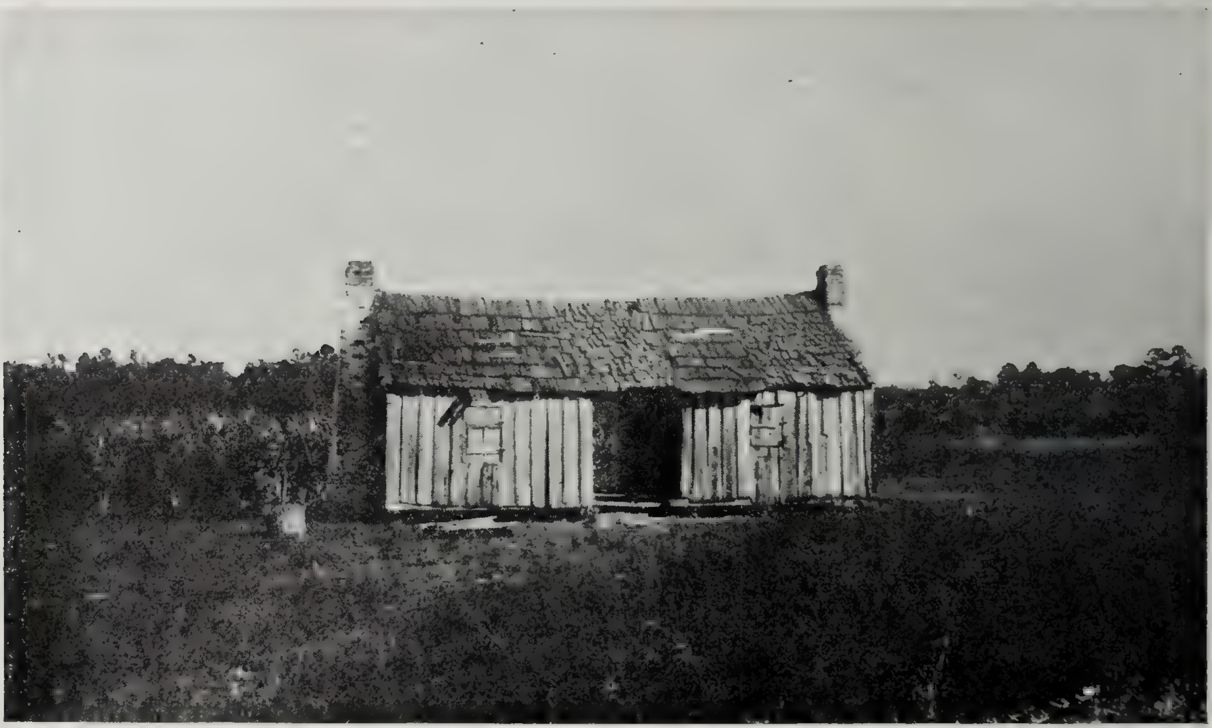

FIG. 3—The picture one carries away after traveling over the Black Belt is that of a gently rolling prairie with negro cabins standing in open fields. (Photograph by R. M. Harper.)

MAIN STREET AND THE OLD MARKET

There is little to be said about the business street of Greensboro. It is no better and no worse than the "main street" of the average American village or town. However, it is of interest to the Northerner on a Saturday when the negroes come to town to do their trading and as compared with the whites number perhaps 25 to one. Although most of the buildings have been erected since the close of the Civil War, the street was probably even less inspiring in "the old time" than now. There is one building, however, that gives it a flavor of the Old South. It is the old market, and, although now used for other purposes and standing in a back yard, it assists one to reconstruct the life of sixty or seventy years ago. It is doubtful, though, if this market was ever an important institution in the life or economy of the village in *ante bellum* days, as most of the plantations were nearly self-supporting.

The presence of the college on the edge of the village tells much of the ambitions and aspirations of the settlement. College and mansion, overseer's home and negro cabin give a picture that is typical. Let us now extend our view over the Black Belt as a whole.

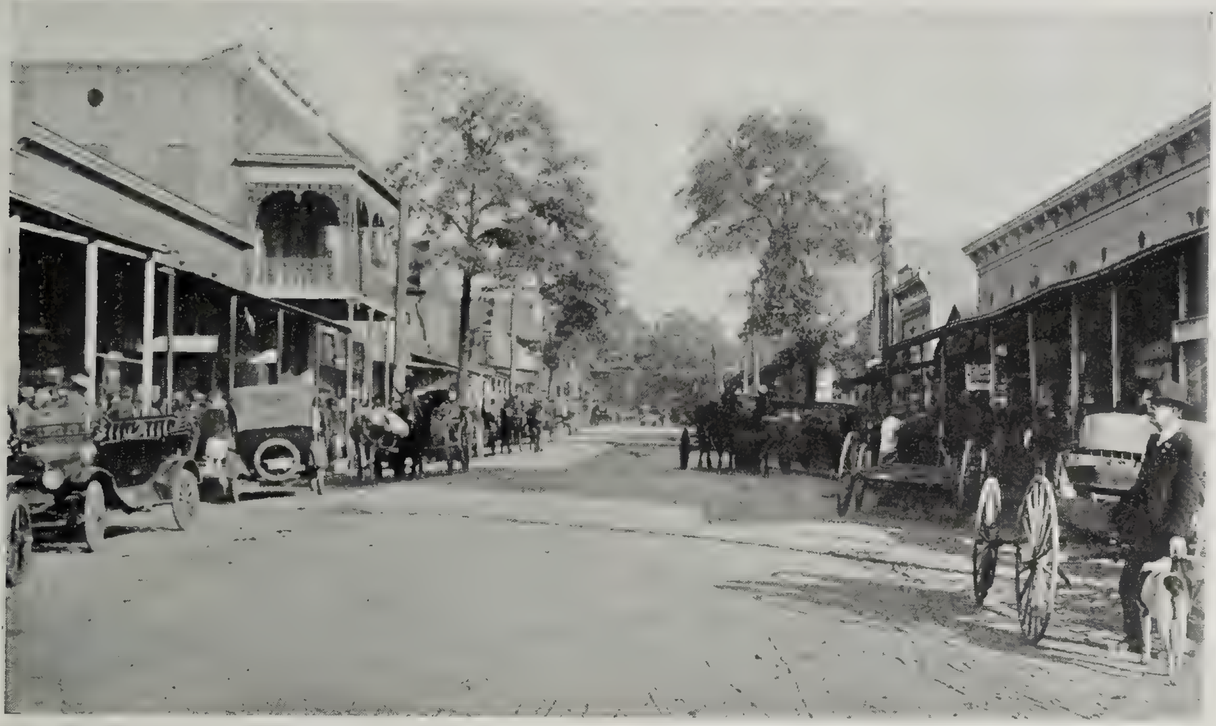

FIG. 4—The "main street" of Greensboro. On Saturdays the negroes come to town in large numbers to do their trading and at least 25 negroes will be met on the street to one white person. The automobile has not entirely replaced the mule-drawn vehicle.

WHAT IS THE BLACK BELT?

The Black Belt, also called "Black Prairie" and "Canebrake" and "Cotton Belt," is not so named because of the large number of negroes, although it happens that the proportion of negroes to whites is 78 to 22, the highest in the state, but because of the dark color of the soil which is in striking contrast to the red and yellow soils of most of the state. This strip of rich, black soil has an average width of 20–25 miles and an area in the state of about 4,300 square miles and extends in an east-west direction nearly across south central Alabama. It conforms almost exactly with the easily decomposed, impure, chalky, Cretaceous limestone (Selma chalk) which has a thickness of about 1,000 feet in the western part of the state and disappears in the east, near Montgomery. This formation dips to the south at the rate of 30–40 feet to the mile while the surface slopes at a much less rapid rate in the same direction.[3] The weathering of the beveled edges of this

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[3] E. A. Smith: The Underground Water Resources of Alabama, *Geol. Survey of Alabama*, Montgomery, 1907.

"rotten limestone" determined the width and position of the Black Belt; and the soil formed from it is a clay of exceptional fertility but somewhat difficult to work because it bakes in summer and becomes tenacious mud in winter.

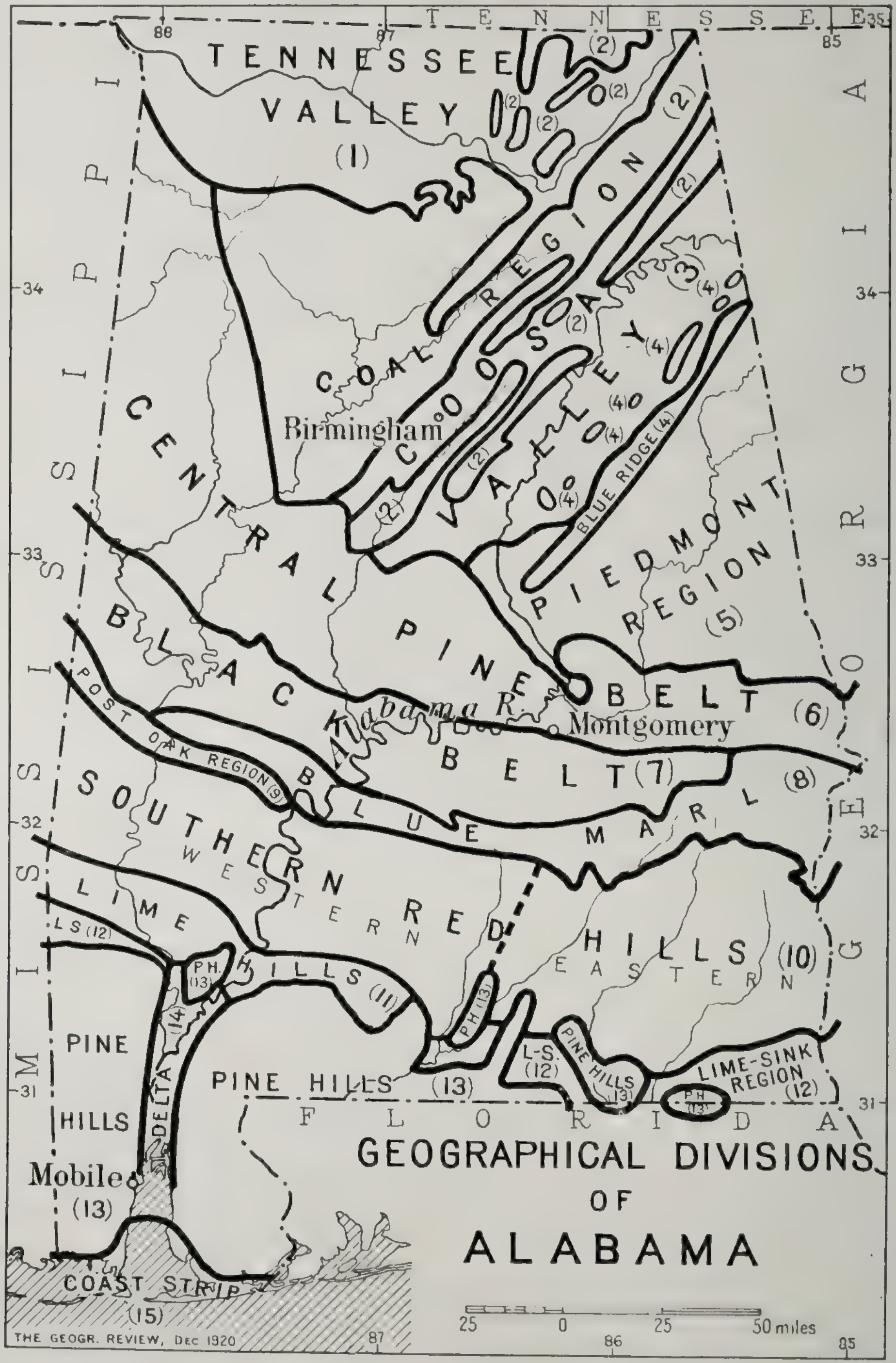

Fig. 5—Geographical Divisions of Alabama after R. M. Harper. Harper's geographical divisions are given in the maps accompanying Geological Survey of Alabama Monograph 8 (Geographical Report on Forests), 1913, and Special Report No. 11 (Resources of Southern Alabama), 1920.

Physiography of the Black Belt

Physiographically the Black Belt is a trough-shaped depression with a gently undulating surface parts of which, "mostly remote from the rivers, are so level that the railroads have built several tangents (i. e. straight tracks) a dozen miles or more in length."[4] In the whole region, with the exception of the river bottoms, swamps are rare, notwithstanding the clay soil.

An early writer characterized it thus: "In the uncleared parts of the canebrake one can scarcely satisfy himself that he is not standing on the low grounds of a river; the deep, alluvial-looking soil beneath his feet, the moisture-loving long moss (*Tillandsia usneoides*) above his head, together with an undergrowth of *Sabals*, *Palmettoes*, and other natives of damp soils, strengthen the illusion."[5]

As one rides over the gently rolling surface of this region and crosses the steep-banked gullies and the bluff-bordered rivers one is impressed with the aspect of topographic youth. However, a more careful study forces one to the conclusion that the region is not only not in the youthful stage of a first cycle of erosion but that the surface is a recently raised (Pleistocene) peneplain whose thick residual soil has not yet disappeared and in which the rejuvenated streams have sunk their beds in places 60 or more feet below the surface of the plain.

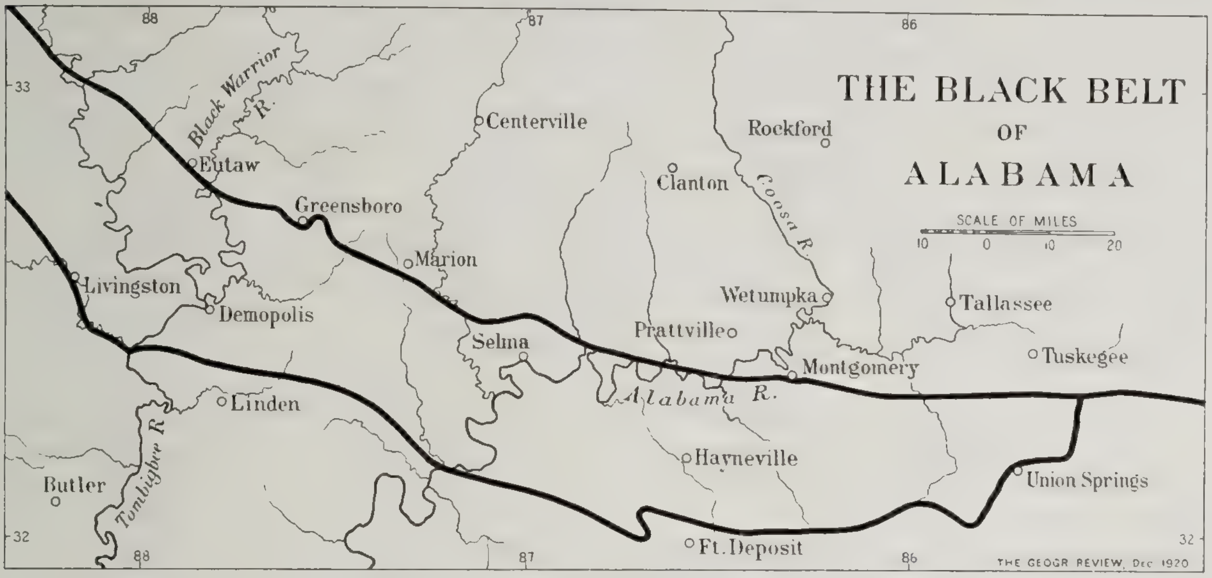

FIG. 6—Location map of the Black Belt.

EARLY HISTORY

The topography, soil, and climate of the Black Belt offered unique opportunities for settlement. In the second decade of last century the cession of Indian lands opened up large areas of Alabama to the westward movement. Pickett, the historian of Alabama, picturesquely describes the movement thus:

> The floodgates of Virginia, the two Carolinas, Tennessee, Kentucky, and Georgia were now hoisted, and mighty streams of emigration poured through them, spreading over the

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[4] R. M. Harper: Economic Botany of Alabama, Part I, Geographical Report, *Geol. Survey of Alabama Monograph 8*, University, 1913, p. 85.

[5] Michael Tuomey: First Biennial Report on the Geology of Alabama, Tuscaloosa, 1850, p. 136.

> whole territory of Alabama. The ax resounded from side to side, and from corner to corner. The stately and magnificent forests fell. Log cabins sprang, as if by magic, into sight. Never, before or since, has a country been so rapidly peopled.[6]

In the case of the Black Belt, however, when first occupied possibly 10 per cent of the surface was treeless so that the early settlers were immediately able to raise an abundant harvest on the rich, virgin soil.

The first mail was brought to Greensboro in 1818, only forty-three years before the opening of hostilities between the North and South, but so rich was the soil and so profitable the slave labor that thirty years after this date the land had been cleared of its timber and the pioneer log cabins largely replaced by the fascinating homes of the southern planter. In fact, one of the finest *ante bellum* houses was built in 1843, only twenty-five years after the settlement of the region, and near Demopolis the famous Gainswood mansion was built only fifteen years after its settlement.

The land of the Black Belt was acquired under homestead acts and by purchase in connection with these acts. A settler was allowed to "homestead" 160, 320, and 640 acres according to the changing laws of the period. Title to practically all of the land was acquired between 1819 and 1839, and, as during this period the law permitted a person to buy large tracts in addition to his homestead at prices ranging from 25 to 30 cents an acre, (though it is reported that some of the land was sold by the General Land Office at public sales for as much as $50.00 per acre), many wealthy persons availed themselves of the privilege and purchased hundreds of acres. One plantation contained 11,000 acres and very few less than 1,000 acres.

THE PLANTATIONS

Most of the planters of the Black Belt lived in towns—several of them situated on the northern or southern edge of the belt—and there built their "big houses" or "mansions." The term "planter" was in common use, and the men who graduated from the University of Alabama before the Civil War and who engaged in agriculture are invariably designated as planters in the alumni catalogue of that University. Because of the extent of the estates it is not surprising to find that some of them were ten, fifteen, and even thirty miles from the planter's home. To reach his plantation the planter was obliged to travel on horseback during the greater part of the year because of the condition of the roads, which when wet were "converted into a mass of clay sufficiently soft to allow his wheels to drop down to the axle, but having a tenacity that no clay ever had."[7]

The number of slaves owned by seven Greensboro planters about whom information was obtained was, on the average, one slave for every ten acres; for example a planter owning 4,000 acres would have 400 slaves. If the negro

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[6] A. J. Pickett: History of Alabama, and Incidentally of Georgia and Mississippi, from the Earliest Period, 2 vols., Charleston, 1851; reference in Vol. 2, p. 385.

[7] Tuomey, *loc. cit.*

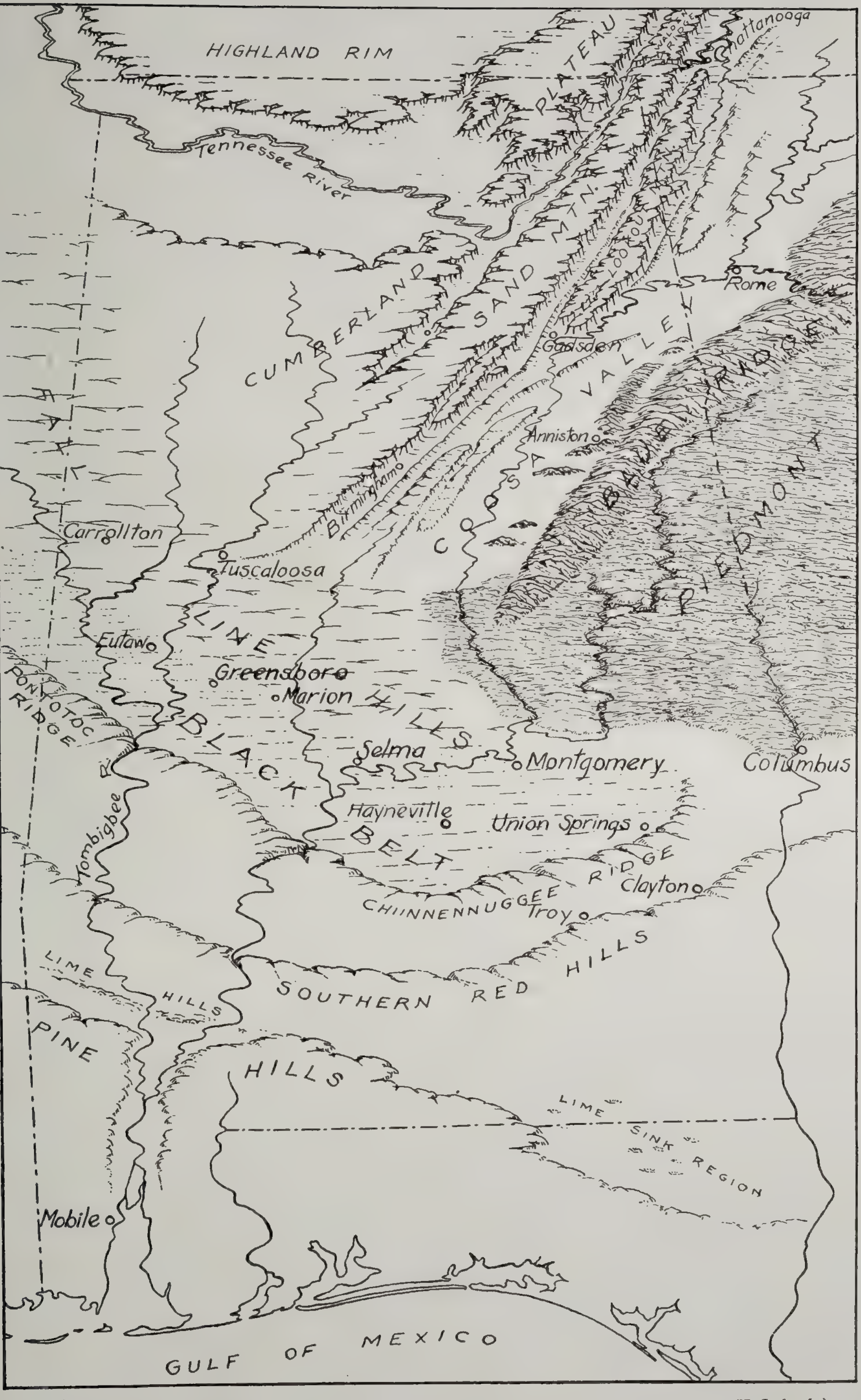

FIG. 7—Diagram presenting a bird's-eye view of the state of Alabama. (Diagram by A. K. Lobeck.)

family had, on the average, six children the man of the family would at this rate care for about 80 acres. Such information is, however, very untrustworthy because of the tendency on the part of the descendants of a family to give the maximum rather than the average number of slaves. The estimate that on a plantation of 2,000 acres there were, on an average, about 75 slaves including men, women, and children seems most probable. Very few planters in the South ever owned as many as 500 slaves.

Social Relations and Culture

One indirect effect of the physical conditions which resulted from the ownership of large plantations was the development of a self-respecting landed aristocracy which, because of the large size of the estates, was relatively small. It is on this account that the knowledge of family history possessed by the older generations of the people of this region is almost uncanny. Mention the name of an old Alabaman family, and doubtless almost any of the older inhabitants can tell you not only a great deal about the family characteristics and history but also who are their "kin" by marriage, even though they had never met a member of the family.

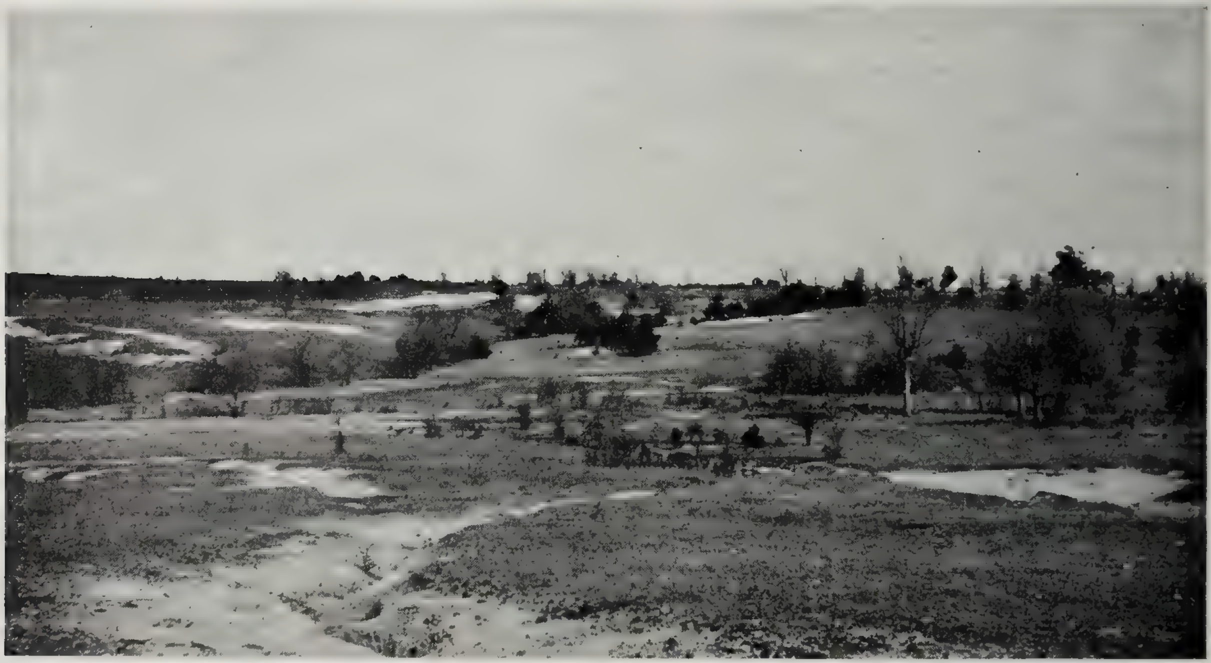

FIG. 8—A typical Black Belt landscape. The white patches are chalk from which the black soil has been eroded. Sumter County. (Photograph by R. M. Harper.)

There is an all too prevalent but unfounded belief that the presence of an inferior race in large numbers lowers the standard of the dominant race. In the Black Belt where the proportion of negroes to whites is larger than in any other part of the United States (except the black counties of the Mississippi River bottoms) and where the average wealth of the landowners is relatively high, the white people have maintained high standards of education and culture. Illiteracy among the whites amounts only to about 2 per cent; that of the negroes is about 44 per cent.[8]

Cultural development of *ante bellum* days was the same as it is the world over where rich lands have yielded wealth and the leisure that promotes a high state of civilization. Bliss Perry has expressed it by saying that with few exceptions the best literature of the world has been the work of men whose energy was not dissipated by poverty. The southern planter was patron and cultivator of the arts. The estate to which he believed himself called demanded the equipment of an education and this of the old-fashioned classical kind. The little college of Greensboro was one of many similar local institutions in the south founded by the planters in their desire for culture and learning at a time when travel was difficult, when roads were even worse, if possible, than they are now, and there were no railroads. In this connection it should be noted that the Black Belt was settled almost exclusively by people from Virginia and the Carolinas, many of whom were from families of wealth and education.

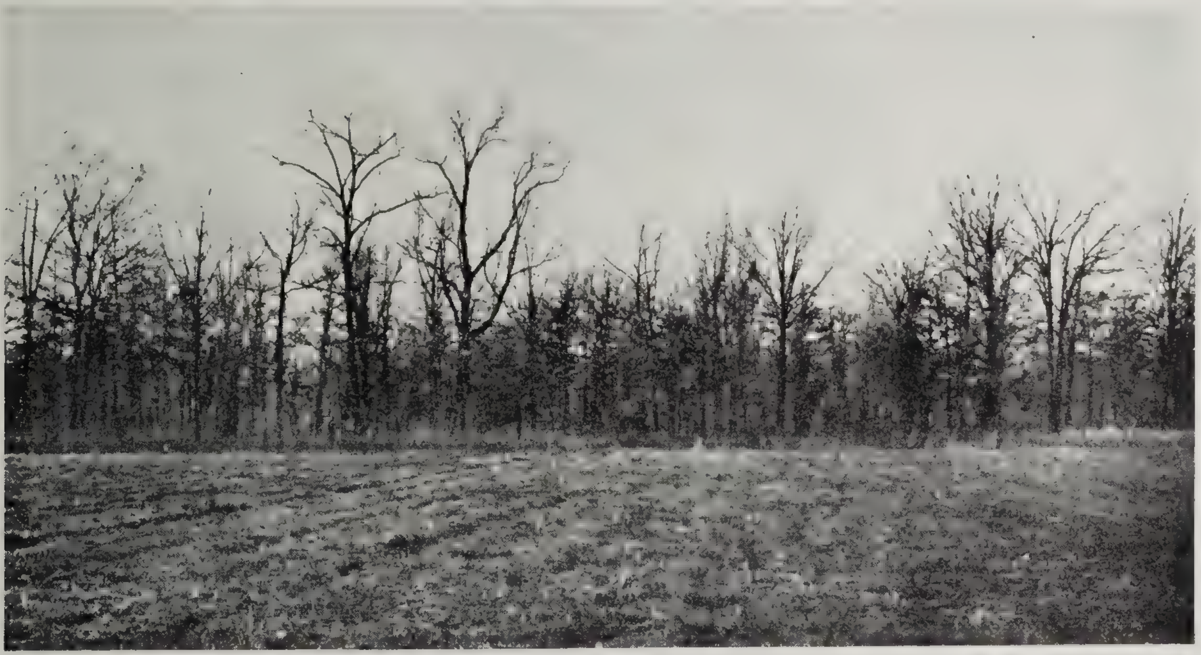

FIG. 9—The foreground shows the level surface developed in parts of the Black Belt. In the background is seen oak woodland also characteristic of the region. (Photograph by R. M. Harper.)

N. S. Shaler, in discussing the culture of central Kentucky where somewhat similar conditions prevailed, says:

> The settlers were prosperous, the burthen of life was light, the climate admirable, so that they were ideally placed for further and high development in the intellectual field. . . . The failure of the Kentucky people to make good their promise . . . is in my opinion to be accounted for by a peculiar combination of circumstances, of which the Civil War was the most potent.[9]

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[8] R. M. Harper in the *Montgomery Advertiser*, June 1, 1919. See also the note on the "Southern red hills of Alabama" in this number of the *Review*, p. 413.

[9] The Autobiography of Nathaniel Southgate Shaler, Boston, 1909, p. 76.

The same may be said of the Black Belt. If the slaves had not been freed so soon after the settlement of the Black Belt and if so many of the intellectual leaders had not been killed in the Civil War, it might have become, in the course of time, a center for literature and art.

"The Lost Cause"

The loyalty for the "Lost Cause," which lingered so long in the Black Belt, was the outgrowth, directly and indirectly, of geographic influences. The most important factors were the lack of natural resources other than soil, such as coal, iron, and water power, and indirectly the negro population. Because of these conditions there was little to attract immigrants; and, as the people were impoverished by the war, they were unable to travel. The consequence was that the deep convictions which their environment engendered were long retained. These convictions were strengthened by the inexcusable policy of Reconstruction times when the organization of the Ku Klux Klan was made necessary in order that the rights of decent people might be safeguarded. It is also probable that not a little of the bitterness toward the North resulted from the poverty in which the people of the South found themselves after the War. According to the historian of Greensboro,[10] it was not until the year 1884 that there was a semblance of building in that town.

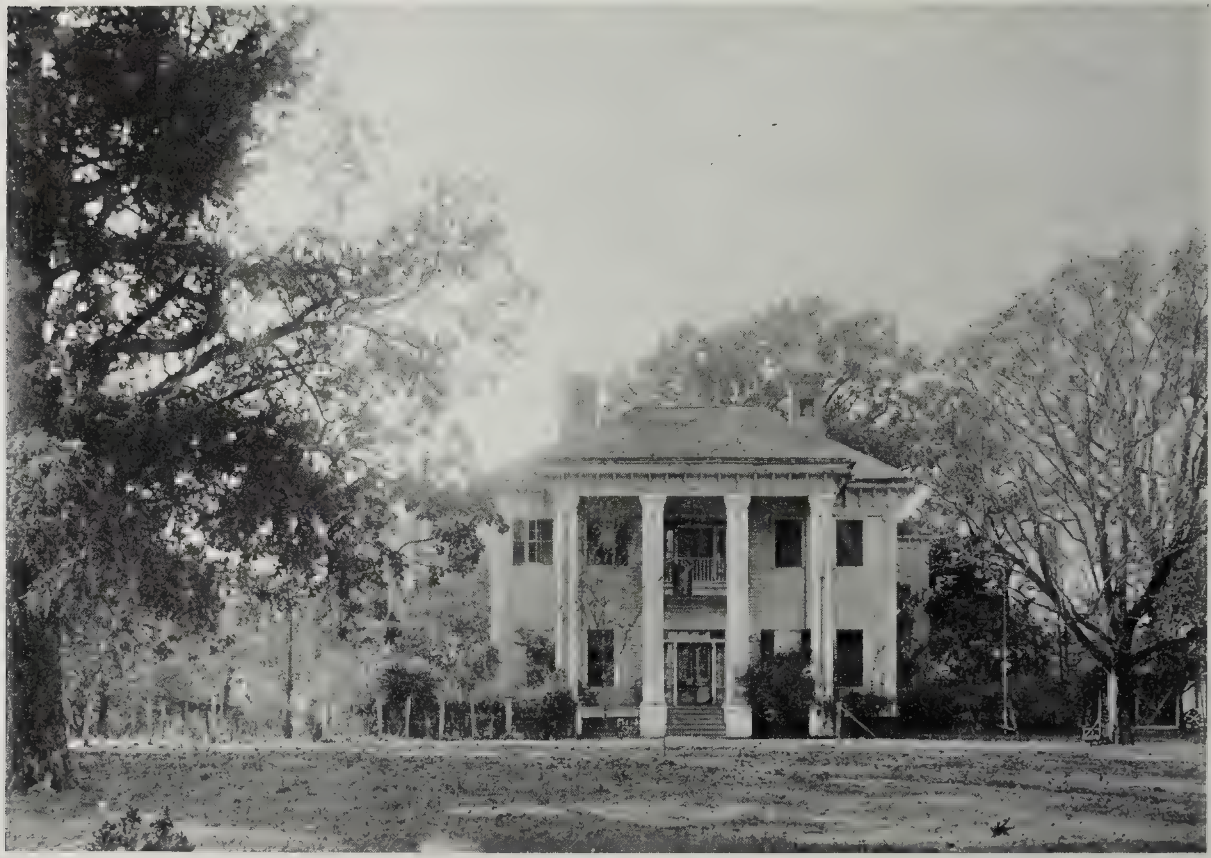

FIG. 10—This mansion was built in 1840, in Greensboro, twenty-two years after the first mail was brought to the region. On a hill about two miles from the town stands the overseer's house, a structure which would have been called a "mansion" had it been occupied by the owner.

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[10] W. E. W. Yerby: History of Greensboro, Alabama, from Its Earliest Settlement, Montgomery, 1908, p. 119.

Loyalty to the Union has come since then. For thirty-three years after the close of the Civil War no United States flag was unfurled in Greensboro; but in 1898 when the news of the destruction of the Spanish fleet by our navy at Manila reached the United States the feeling of pride broke the restraint of a third of a century, and the Stars and Stripes again floated to the breeze to celebrate the victory. The Spanish American War, the election to the presidency of Woodrow Wilson, a man born south of the Mason and Dixon line, the great World War, and the passing away of many of those who fought and suffered in the Civil War, have combined to make of the people of the Black Belt loyal defenders of the country, though always retaining an affection for the Stars and Bars.

Recent Changes in the Black Belt

Many things have conspired to leave Greensboro nearly untouched by change. Even the railroad is a branch line and is about a mile from the town. There are no factories to attract foreigners or laborers from other states, and few outside influences have affected its placid life since the Civil War. But now after its sleep of fifty years this Old South town is rapidly losing its isolation, and the same is true of many other towns of the region. Roads are being rapidly improved, and the omnipresent automobile is doing its share in the awakening.

Upon the death of the old planters the land is divided among their heirs or is sold, and the great estates are disappearing. Already one sees by the roadside advertisements offering sixty-acre farms for sale, and much land has been purchased in the past ten years by people from the Middle West. Before another fifty years shall have passed the land of the Black Belt will probably have been broken up into many small farms, few or none of the princely *ante bellum* estates of hundreds of acres will remain, and most of the old "mansions" will have passed into the hands of strangers. One sometimes wishes that the English law of primogeniture were in force in this country so that these estates might be handed down intact to the first-born from generation to generation. But perhaps it is better that the new order replace the old, since a greater number of people are benefited by the breaking up of the great plantations. This will result in a greater density of population, greater wealth, better roads, and less illiteracy among the negroes.

The saddle horse of the planter has already been largely supplanted by the automobile; the old families are gradually disappearing from the towns; and in a few years the descendants of those who made the romantic civilization of the Old South will be few. The record of the past will soon be found only in courthouse documents, on the gravestones of the ill-kept cemeteries, and in material form in such *ante bellum* homes as shall have escaped the ravages of fire and decay.

ARRIVAL AND DEPARTURE OF WINTER CONDITIONS IN THE MACKENZIE RIVER BASIN*

By E. M. Kindle
Geological Survey of Canada

The life of the few white inhabitants of the Mackenzie Valley north of Lake Athabaska is intimately bound up with the waterways of the great river system. Interest still centers almost exclusively in fur trading. The annual export of furs from the basin as a whole is said to amount to some $2,000,000. Its transportation is dependent on the rivers. The railway ends near McMurray: from that point to the Arctic coast steamer navigation on the Mackenzie is interrupted at but one point, the rapids at Fort Smith. Two lines of steamers have for a number of years been engaged every summer in bringing out the winter catch of fur and taking in the yearly consignment of supplies to the trading ports which are located from 100 to 200 miles apart throughout the Mackenzie River system.[1]

During the winter season the only communication between the Mackenzie Valley and the outside world is maintained by dog sledges or carioles (Fig. 2) which carry the mails in and out of the Mackenzie Valley once a month. Only first-class mail, however, is carried on these.

It may well be understood that to the inhabitants the great seasonal events of the year are the opening and closing of navigation on the waterways of the basin. These are also events of interest to the geologist and geographer.

The appearance and disappearance of winter ice in the Mackenzie Valley mark the limits of the seasonal period during which the processes of erosion are active over about one quarter of the continent. As will subsequently be shown, this period is relatively short in Northwestern Canada as compared with more southerly latitudes, a circumstance which must result in a correspondingly slow degradation of the land surface.

Winter Conditions

The character of the winter temperature in Northwestern Canada is indicated in Table I, which shows the minimum temperatures (in degrees Fahrenheit) recorded in each of the winter months, 1915–1916 to 1918–1919 inclusive, at Fort Simpson, Hay River, and Edmonton.

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* Published with the permission of the Director of the Geological Survey of Canada.

During two field seasons spent in the Mackenzie Valley the writer has had an opportunity to note the dates and some of the features incident to the opening and closing of navigation on the Mackenzie and its larger tributaries. On each of his trips to the Mackenzie, Great Slave Lake was entered as early as the ice would permit. The journey out in 1919 was completed after many streams and small lakes had been closed by ice.

[1] See E. J. Alcock: Past and Present Trade Routes to the Canadian Northwest, *Geogr. Rev.*, Vol. 10, 1920, pp. 57–83.

Probably no better authority for the character of the winter climate of the lower Mackenzie Valley can be cited than R. MacFarlane, who spent many years in the region. He wrote as follows of the winter conditions at Good Hope:

> During the months of January and February, 1863, the thermometer was frequently as low as 50° and 60° below zero of Fahr.; it was also several times down to 65° and 66°, and once actually at 70°! Notwithstanding this fearful cold, we trip all the same. [See Fig. 2.] I was travelling myself, accompanied by six loaded sleds, on the voyage from Good Hope, during this severe cold. Last winter, however, was by no means so severe; the thermometer was comparatively seldom at 50°; it was once only at 55°, and once also 60° minus. In summer it is exceedingly hot at times.[2]

TABLE I—MINIMUM TEMPERATURES IN NORTHWESTERN CANADA[3]

STATION	SEASON	MONTH					
		Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Fort Simpson (lat. 61° 50′ N.)	1915–16	—19	—39	—45	—48	—44	— 7
	1916–17	—14	—48	—55	—62	—31	—18
	1917–18	—21	—57	—54	—45	—34	—24
	1918–19	—20	—24	—48	—55	—44	— 6
Hay River (lat. 60° 50′ N.)	1915–16	—18	—37	—51	—44	—45	— 8
	1916–17	—17	—40	—55	—55	—43	—24
	1917–18	—20	—60	—58	—50	—42	—24
	1918–19	—20	—34	—38	—56	—52	
Edmonton (lat. 53° 33 ′N.)	1915–16	— 3	— 6	—45	—37	—20	—17
	1916–17	— 8	—37	—44	—50	— 8	— 7
	1917–18	—13	—42	—43	—33	—28	— 2
	1918–19	— 3	— 0	—15	—37	—32	—22

It is evident that in a region of great lakes and great rivers, where nearly every winter shows a lowest temperature of 50° F. or more below zero, a vast quantity of ice must prevent erosion and navigation for a long period.

THE SPRING BREAK-UP

The break-up of the ice in spring begins in the small streams. Joseph Keele, who spent a winter in the Mackenzie Mountains, describes it thus:

> In spring, the small side streams are the first to open, then the pressure from the increase of water in the main streams arches the ice sheet and finally breaks it up. The broken ice usually jams at some point lower down, the pent-up water behind the jam breaks out again and sweeps the river clear of ice. This operation is repeated until the entire river is open, no ice being left at the margins.[4]

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[2] R. MacFarlane: An Account of the Mackenzie River District, *Proc. Royal Geogr. Soc.*, Vol. 9, 1864–65, pp. 125–131; reference on pp. 129–130.

[3] Furnished to the writer by the Canadian Weather Bureau.

[4] Joseph Keefe: A Reconnaissance Across the Mackenzie Mountains on the Pelly, Ross, and Gravel Rivers, Yukon and North-West Territories, Geol. Survey Branch, Dept. of Mines, Ottawa, 1910, p. 20.

The formation of ice jams often leads to rapid and destructive rises in the northern rivers. At the mouth of the Clearwater River a rise of about 30 feet, which was caused by an ice jam in the spring of 1919, resulted in the loss of a large quantity of provisions stored at McMurray. Alfred H. Harrison described the break-up as he observed it on the Slave River as follows:

> The breaking up of the ice on these rivers is a grand sight. In the spring of that same year I happened to be encamped about two miles above a bend in the Slave River: in this bend the ice, which had broken in mid-stream, got jammed, and during that night the water, in three hours, rose 14 feet. Sometimes, indeed, the ice gets piled 20 feet high in places and seems to be solidly blocked right down to the bottom of the river; for as the ponderous fragments come along, they are drawn in underneath the pack, and it is only when the water has risen in this manner that the stream at length finds outlet and rushes away with a terrific roar, sweeping away the vast wreckage in its onset; and therewith the ice has wholly passed away for the season, saving only some isolated masses that emerge many days afterwards, covered with mud, from the river bed into which they have been driven by the enormous pressure from above.[5]

A photograph[6] taken by the writer shows a remnant of one of these ice jams on the bank of the Mackenzie which had a thickness of 25 feet in the last days of July.

The ice of Great Slave Lake blocks the navigation of the Mackenzie River for nearly a month after the great river is free of ice (Figs. 3 and 4). Owing to this fact navigation on the Mackenzie is limited to about three and one-half months. The record of the ice break-up at Rae on Great Slave Lake entered in the Hudson's Bay Company journals and published by Russell[7] shows the break-up during 6 years (1857–1859 and 1883–1885) to have ranged from May 30 to June 23. The general direction of the wind in spring, however, drives the ice toward the southern shore so that steamers seldom venture into the lake before the first of July. The photograph (Fig. 4) shows the character of the Great Slave Lake ice encountered by the writer late in June, 1917. Ice floes were present on the southern shore of the lake up to June 30 in 1917. In 1919 the writer passed through Great Slave Lake the last week in June without seeing any ice. Mr. Vail of Hay River reported that the ice disappeared in 1919 about June 15, an unusually early date.

The Mackenzie at Simpson, which is near latitude 62°, opens from May 4 to May 20, averaging from the 10th to the 15th, according to Captain Mills, who has spent several years at Simpson and has run steamers on all of the navigable waters of the Mackenzie basin. Because of nearly dead water in the Mackenzie for a long distance, the head of the river opens two and a half or three weeks later than at Simpson. The opening of Great Slave Lake generally occurs, according to Captain Mills, between June 16 and July 2, or six weeks later than the Mackenzie below Simpson.

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[5] A. H. Harrison: In Search of a Polar Continent, 1905-1907, London, 1908, pp. 17-18.

[6] E. M. Kindle: Notes on Sedimentation in the Mackenzie River Basin, *Journ. of Geol.*, Vol. 26, 1918, pp. 341–360; reference on p. 355.

[7] Frank Russell: Explorations in the Far North, Univ. of Iowa, Iowa City, 1898, p. 86.

McConnell states that the Liard ice broke into the Mackenzie May 13 in 1888. This is nearly six weeks before the ice in Great Slave Lake will permit steamers to reach the Mackenzie. The Liard, which is the largest tributary of the Mackenzie, breaks up before the Mackenzie and opens that stream below its mouth while the upper part of the Mackenzie is still covered with ice. The sudden rush of the Liard waters and broken ice across and through the deeply frozen surface of the Mackenzie is a spectacular feature of the break-up at Simpson. The jammed ice frequently piles high above the Hudson's Bay Company's stockade at Simpson before the firm ice of the main stream gives way and lets the Liard waters crash a channel across the Mackenzie. McConnell gives the following account of the Liard breaking into the Mackenzie:

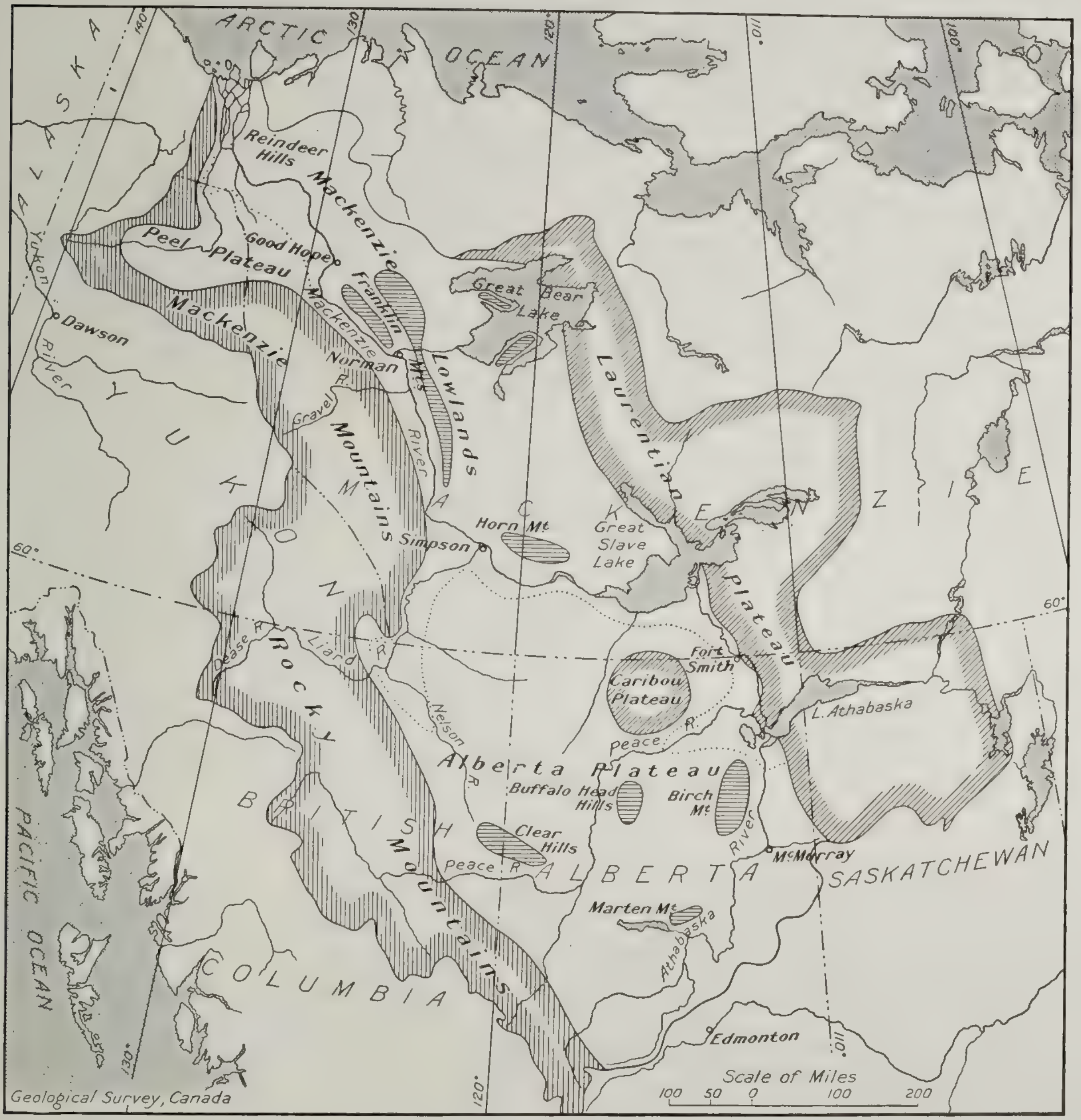

FIG. 1—Diagrammatic map of the physiography of the Mackenzie River basin. (After Camsell and Malcolm: The Mackenzie River Basin, *Geol. Survey of Canada Memoir* 108, 1919.)

> At midnight the dam at the mouth of the Liard gave way, and the massive crystal structure was hurled by the liquid energy behind it against the firm ice in front with such force that the whole sheet, for some miles below the fort, was crushed into fragments by the impetuosity of the assault.[8]

The appearance of the ice encountered on the river bank after the jam has given way and the water fallen, is shown in Figure 5. The moving mass of ice set free by the break-up is shown in Figure 6. There is scarcely a mile of the river banks that does not show traces of the destructive work done by these great blocks as they travel seaward. In some places the spruce trees at the top of the banks have been snapped off like straws; in others the clay banks have the appearance of having been plowed by titanic plows. In late summer the gravel bars about the mouths of tributary streams often show numerous grooves cut by the shoving of grounded ice blocks.

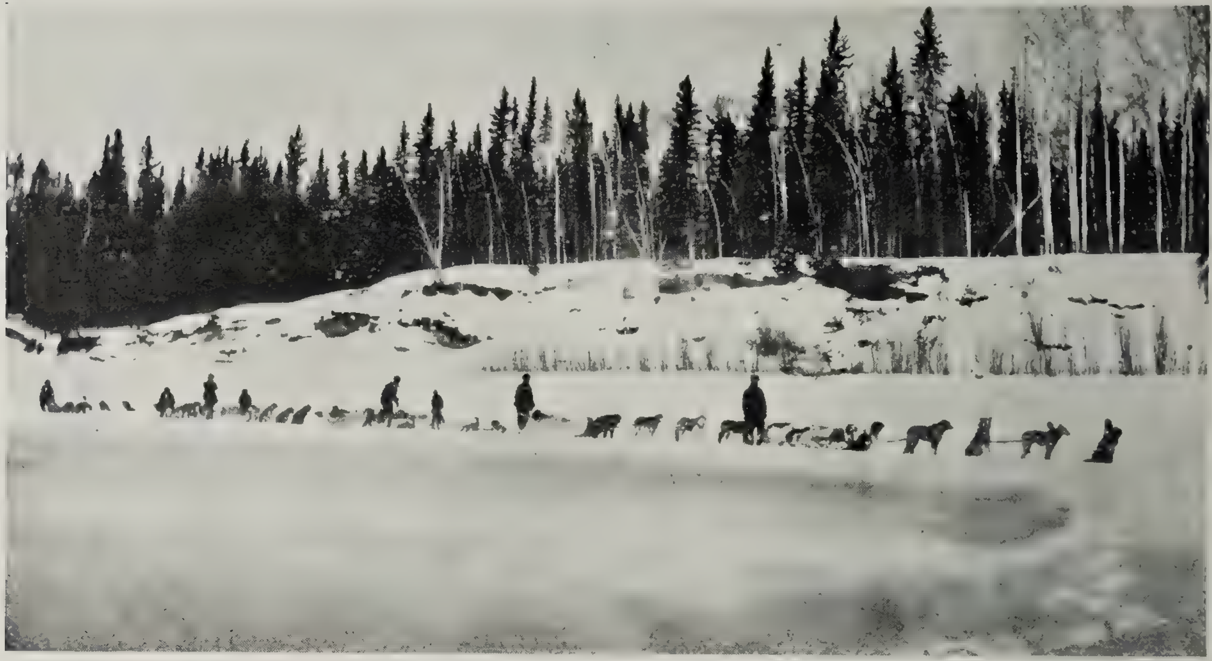

FIG. 2—Winter travel on the Athabaska River.

The Nelson River, which is the largest southern branch of the Liard, breaks up, it is said, as early as the main stream which, as stated above, opens the Mackenzie below Simpson more than a month before steamers can get through the ice on Great Slave Lake. The Nelson is large enough for navigation by small steamers as far as Fort Nelson, 100 miles above its mouth, and for flat boats still farther south. The construction of a wagon trail or railway from St. John on the Peace to the upper part of the Nelson River, a distance of about 175 miles, would give access to the Mackenzie River more than a month earlier than is now possible, owing to the late opening of Great Slave Lake. The success of the first oil well ever drilled in the Mackenzie Valley in getting oil during the past season may eventually lead to the serious consideration of this entirely feasible method of lengthening the navigation season of the Mackenzie by one month.

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[8] R. G. McConnell: Report on an Exploration in the Yukon and Mackenzie Basins, N. W. T., *Ann. Rept. Geol. Survey of Canada*, Vol. 4 (N. S.), 1888–89, pp. 1 D–163 D; reference on p. 87 D.

McConnell, the pioneer geologist in the Mackenzie Valley, spent the early spring of 1888 at the mouth of the Liard. His graphic description of early spring conditions follows:

> The warm weather which commenced on the 1st of May continued throughout the month, and under its influence the snow quickly disappeared, and the spring advanced with astonishing rapidity. On the 20th of April, the first day the temperature rose above freezing point for nearly six months, the barking crow (*Corvus americanus*) made its appearance. The raven (*Corvus corax*) had remained throughout the winter. On the 1st of May some Canada geese (*Branta canadensis*) were seen at the edge of an open place in the river, accompanied by a flock of mergansers and other ducks. The 4th brought the robin (*Turdus migratorius*) and some sparrows, and on the 5th the wavies (*Anser hyperboreus*) which usually lag a few days in the rear of the Canada geese, commenced to wing their way northwards and in a couple of days were passing in such numbers that flocks were rarely out of sight.[9]

FIG. 3—Fishing through the ice on Great Slave Lake.

In speaking of the western tributaries of the Mackenzie River in a region some 400 miles north of the mouth of the Liard, Keele[10] states that the rivers open between May 10 and May 20 and flood water comes down early in June.

MIDSUMMER CONDITIONS

All traces of winter conditions have disappeared from the Mackenzie Valley by the time the first steamer is able to get through Great Slave Lake to the head of the river, which is usually early in July. Concerning the climate of early summer Keele, who wintered near the head of the Gravel River, remarks that "June is a perfect summer month with practically no darkness and on fair days nearly twenty hours of bright sunshine; the temperature sometimes reaches as high as 90°."[11] The nearly continuous sunshine of June is the great factor in the exceedingly rapid development of vegetation. "Compared with Ottawa, Simpson has an average of three hours more sunlight daily for the summer months, which means about eighteen days of additional sunshine during the three months when sunshine is most important."[12]

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[9] McConnell, p. 86 D.

[10] *Op. cit.*, p. 23.

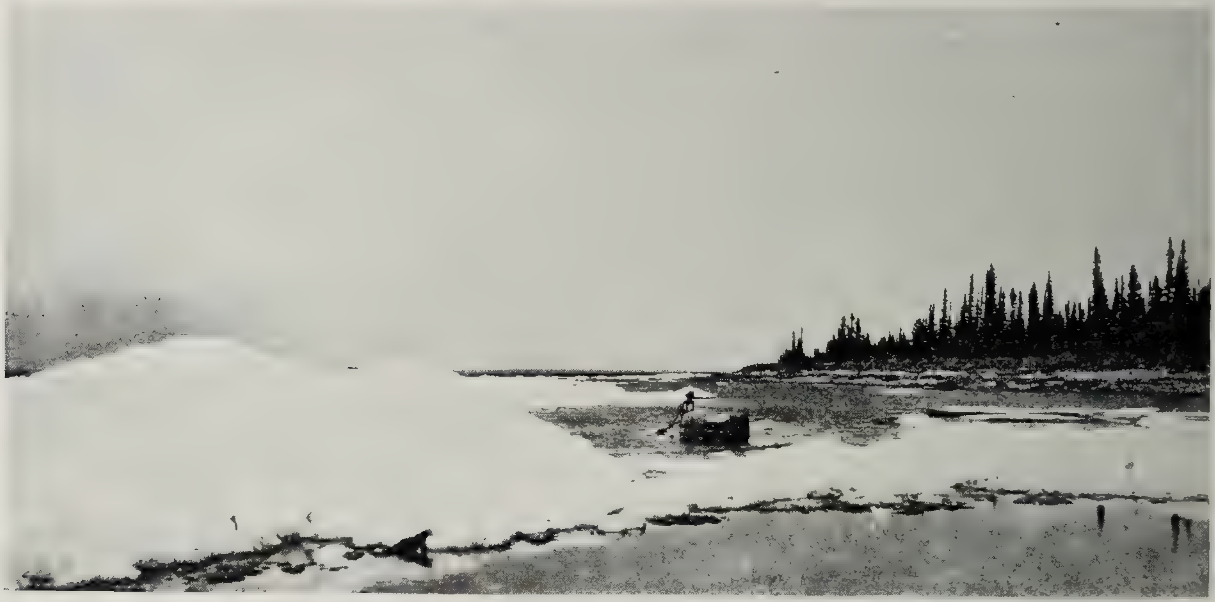

FIG. 4—The last stage of winter ice on Great Slave Lake. (Photograph taken June 28, 1917.)

The traveler in the Mackenzie Valley who sees for the first time the limestone scarps and cliffs of the Mackenzie Mountains so near the Arctic Zone entirely free of snow in midsummer, is apt to be surprised when he recalls the glaciers and permanent snow fields which are familiar features of the same mountains many hundreds of miles farther south. The Nahanni Mountains of the Mackenzie Valley, which are quite free of snow in July, are in about the same latitude as the mouth of Frobisher Bay, Baffin Land, where the writer has seen a ship stuck for days in the ice floes and experienced a snow storm late in July. The warm genial summer climate of the Mackenzie Valley cannot fail to impress anyone who is familiar with the bleak coasts of northeastern America which lie in the same latitude. Although the middle portion of the Mackenzie Valley lies in about the same latitude as Baffin Land, its summer climate bears a much stronger resemblance to that of the Gaspé Peninsula in the Gulf of St. Lawrence than it does to the Baffin Land summer. Camsell, who has a more intimate knowledge of the climate of the Mackenzie Valley as a whole than anyone else who has written on the subject, states that "in general it may be said that any point in the Mackenzie basin has a milder climate than any corresponding point of the same latitude in northern Manitoba, Ontario, or Quebec."[13] The relatively warm summer climate of the Mackenzie Valley may be ascribed chiefly to its remoteness from the chilling influence of Hudson Bay and to its low average elevation. Most of this great lowland is less than 500 feet above sea level, while much of the northern half of Alberta immediately south of it lies 2,000 or more above tide. Warm air currents from the Pacific may also be a factor.

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[11] *Op. cit.*, p. 22.

[12] Charles Camsell and Wyatt Malcolm: The Mackenzie River Basin, *Geol. Survey of Canada Memoir 108; Geol. Ser. No. 92*, Ottawa, 1919, p. 43.

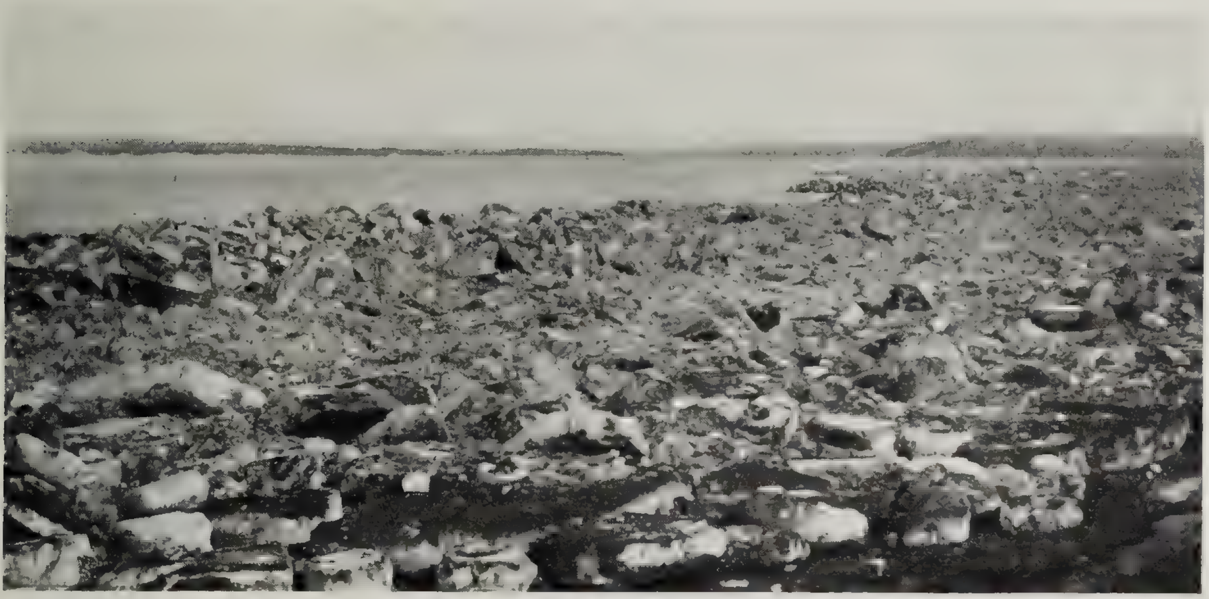

FIG. 5—Stranded silt-covered ice left on the bank after the Liard has broken across the Mackenzie. (Photograph by Captain Mills.)

Many varieties of flowers in bloom crowd the fire-cleared spaces of the lowland and the mountain slopes early in July. Among these, two species of orchids occur locally in abundance. Ripe red raspberries were seen on August 7 at Bear Mountain, which is about 80 miles south of the Arctic Circle. Blueberries were a feature of the writer's camp fare from the first week in August to the end of the summer. The wild strawberry is abundant along the Mackenzie as far north as Simpson, at the mouth of the Liard, which appears to be near the northern limit of its range. No trace of it was seen north of Simpson, and inquiry failed to elicit any evidence of its having been seen by others farther north.

The gardens of the agents of the trading companies which may be seen at intervals of 150 to 200 miles along the Mackenzie show that excellent crops of all the more hardy garden vegetables may be grown in favorable seasons as far north as the Arctic Circle. Potatoes which the writer selected from a field at Simpson weighed in two or three cases a few ounces over a pound each. A turnip—the largest of a lot purchased for camp use from an Indian garden at Simpson—had a length of nine inches and a diameter of five inches, the long tap root not being included in these figures. Oats and barley are raised at Simpson, though ripening is uncertain, and a few cattle are kept there on the Government farm. There is however, always the possibility of an August or July frost destroying the vegetables which in favorable seasons compare well with those raised in southern Canada.

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[13] *Op. cit.*, p. 43.

Thawing in the upper part of the Mackenzie Valley proceeds downward a few feet below the surface in summer. Mr. Harris, who is in charge of the Government farm at Simpson, states that his well entered frozen ground at a depth of about 5 feet and passed out of frost at about 40 feet. A frost limit of 40 feet is in sharp contrast with the conditions prevailing in the Yukon valley and the Nome district in Alaska. Near Nome a shaft 120 feet deep did not penetrate below perpetual frost. Cleveland Abbe states that "there is only one instance on record where excavation in this northwestern region has gone below the zone of perpetual frost."[14] This is a Klondike shaft which passed through the frost zone into flowing water at about 220 feet.[15] The relatively moderate depth of frost penetration in the upper Mackenzie Valley as compared with the lower limit of frost in the Klondike and much of northern Alaska clearly indicates a less rigorous climate.

Autumn Conditions

The writer spent the latter part of August and the first ten days in September in the Wrigley district. At river level the first frost came here on September 1. Snow made its first temporary appearance on the summits of the mountains east of Wrigley (latitude 63° N.) on August 21. After September 7 the summit of Cap Mountain above 4,400 feet was permanently snow-covered. We left Wrigley for Simpson on September 10. In tracking up the Mackenzie and the lower Liard from Wrigley we found the somber dark green of the landscape enlivened by the bright yellow of the numerous patches of poplar which break the otherwise continuous spruce forests. This is the ideal part of the year in the Mackenzie Valley. The mosquito pest, which greatly abates late in August, disappears altogether with the first frost. One can then discard one's protective head net and canvas gloves, which earlier are absolutely essential to comfort if not existence, and sleep comfortably in the open when making short trips inland from the river.

Nearly perfect weather for outdoor work prevailed during most of the month of September. Wild gooseberries in good condition and four species of plants in bloom were seen at Simpson on September 28, the date of our departure for the "outside," as all railway-served lands are called in the north.

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[14] A. H. Brooks: The Geography and Geology of Alaska, A Summary of Existing Knowledge; with a Section on Climate, by Cleveland Abbe, Jr., *U. S. Geol. Survey Professional Paper No. 45*, Washington, D. C., 1906, p. 147.

[15] J. B. Tyrrell: A Peculiar Artesian Well in the Klondike, *Engineering and Mining Journ.*, Vol. 75, 1903, p. 188.

THE COMING OF WINTER

At Simpson the first notable freeze of the season of 1919 occurred on the night of September 25. Thin ice on quiet pools and a crust on wet ground were noted on the 26th. The first strong hint of the approach of winter was encountered at Providence, 50 miles below the head of the Mackenzie (latitude 61° 25′ N.) At that point the writer found two or three inches of snow covering his blankets on waking October 1. At the head of the Mackenzie River in Wrigley harbor we found Mr. Camsell, Hudson's Bay Company factor at Simpson, with the Steamer *Liard River*, which had towed half a dozen Indian scows up to the lake where the main winter supply of fish for men and dogs is caught late in September and early in October. Fishing, however, does not cease with the coming of ice, as may be seen from the photograph, Figure 3. It was still too early for ice to form on Great Slave Lake when we crossed it early in October. According to Hudson's Bay Company journals kept at Rae on Great Slave Lake, the earliest closing of the lake recorded there is October 6, 1864. In 1857 ice closed the lake on October 19, and in 1880 on October 28.[16] Ordinarily the upper Mackenzie is closed to canoe navigation by running ice about the middle of October. Mr. Blow, a missionary, informed the writer that in 1918 the Mackenzie first froze over at Norman on November 6. It broke and finally froze solid on November 11. A. H. Harrison[17] found the lower Mackenzie still open at Arctic Red River on October 4 in 1905 although he had encountered floating ice several days earlier.

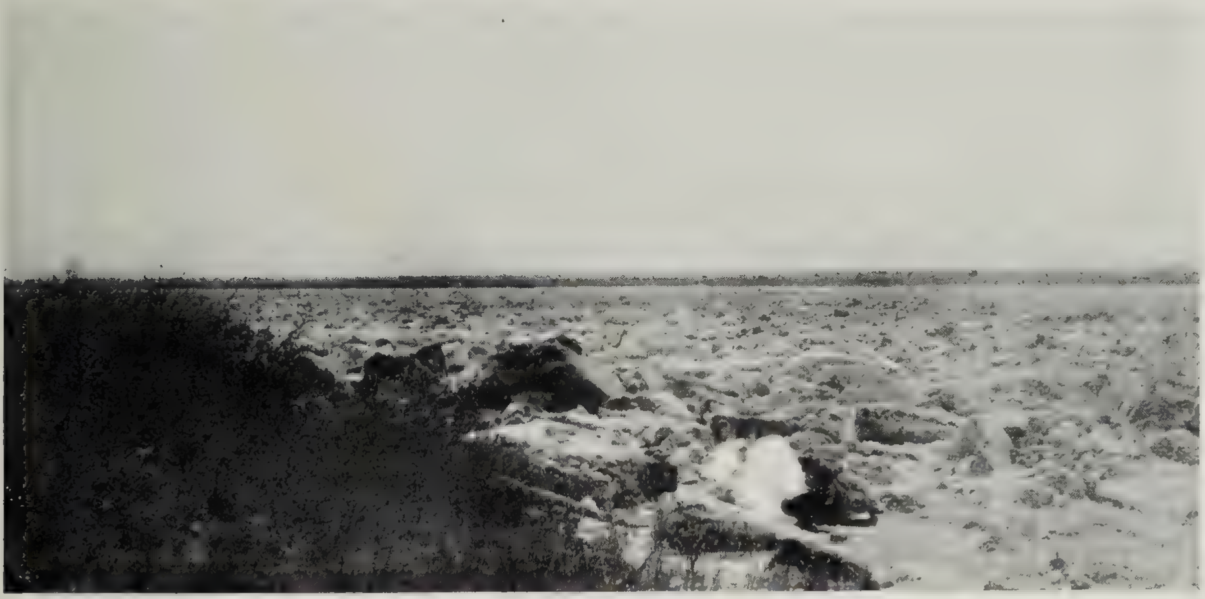
FIG. 6—Ice moving down the Mackenzie at Norman.

A light snow covered the entire landscape when the launch carrying the writer's party arrived at the foot of Smith Rapids on October 4. This snow remained during the four days spent in portaging the 16 miles of rapids and getting started again on the upper Slave, and snow-covered river banks were a feature of the landscape during the remainder of the journey.

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[16] Russell, *Op. cit.*, p. 86.
[17] Harrison, *Op. cit.*, p. 28.

The freeze-up of the Slave was not yet due for two weeks according to those familiar with the river, but the low temperature, snow, and frozen ground strongly suggested its imminence at the time of our departure from Fitzgerald at the head of the Smith Rapids. Thin cakes of floating ice, which were encountered constantly after leaving this point, became steadily more numerous and thicker. On reaching the mouth of the Peace an attempt to avoid a rapid in the Slave by going through the delta of the Peace via the Quatre Fourches Channel failed because solid ice had entirely closed this relatively sluggish channel. We were forced to retrace our way back to the swifter main channel of the Rocher River leading to Lake Athabaska. Much ice was encountered in the very shallow western arm of the lake. The ice conditions met with from near the head of the Slave to the mouth of the Clearwater are indicated in the following excerpt from the writer's notes:

Oct. 9. Turned back by ice in the Quatre Fourches Channel in afternoon. Ice 1 inch thick. Where broken up and overslid, 2 to 4 inches thick.

Oct. 10. Met constant floes of fresh pan ice in upper part of Rocher River.

At Chipewyan (on Lake Athabaska) the protected bays have about 1 inch of ice over them, but no ice in the wind-swept water.

In shallow western end of lake ice is abundant except in the main current of the river.

Oct. 12. Much ice in middle of river in A. M. ⅛ inch thick, but in floating sheets. Quite cold during last night.

Oct. 13. Reached McKay (50 miles below McMurray) in A. M. where we abandoned the scow, which was nearly cut through by ice, transferring baggage to two skiffs. One skiff was broken through by ice and set adrift in afternoon. Reached the steamboat cache at night. River nearly covered by floating ice pans of all sizes up to 60 feet across, but all moving.

The current and contact of the ice pans tends to give them a rotary motion, tending to round off the corners and make circular pans.

Oct. 14. Started on foot for McMurray (16 miles) this A. M. after sleeping in the open under a spruce tree very comfortably. Launch was beached, repaired, and followed with baggage.

Small streams and channels of river with no current frozen over solid with smooth ice.

Big pans of ice five or six inches thick moving freely in current but extending nearly across the river. These floating pans, though thick, are mushy; but where there is no current, hard ice 1 to 2 inches thick.

Reached bank of Clearwater about 4.30 P. M. Crossed in canoe in thick floating ice to McMurray.

The southern channel of the Clearwater at McMurray we found frozen solid enough to permit of crossing on foot.

The nearly continuous sheet of moving ice in the Clearwater made navigation impossible about 18 miles from McMurray, so that the last 35 miles of the journey back to the railroad was accomplished on foot.

People residing at McMurray assured the writer that the freeze-up in 1919 came several days earlier than usual. But that it was not without precedent is shown by Hanbury's experience some 18 years ago. He was frozen in at McKay (where we abandoned the scow) on October 15 and resumed his journey a month later with dogs.[18] Information from various sources indicates, however, that in 1919 winter began at an unusually early date. The freeze-up came equally early on the Yukon River. The newspapers, under date of October 15, reported two steamers delayed and one frozen in north of Dawson. D'Arcy Arden, who shares with another man the distinction of representing the only white inhabitants of the immense region comprising the basin of Great Bear Lake, writes as follows concerning the early arrival of winter on Great Bear Lake in 1919:

> I was frozen in on October 4 at Cape McDonnell, Great Bear Lake, after being in the worst storm I have ever seen, lasting five days. I lost both my anchors and every foot of line I had and landed up on a sandy beach on a small island eighty miles from home.[19]

The early appearance of winter conditions did not yield, in 1919, to temporary milder weather. Snow and frozen ground were encountered all the way from Fort Smith to Edmonton where the temperature on October 25 was reported to be 15° below zero. In traveling eastward a continuous sheet of snow was found late in October as far as western Ontario.

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[18] D. T. Hanbury: Sport and Travel in the Northland of Canada, London, 1904, p. 253.

[19] Letter of August 10, 1920.

THE ORIGIN OF LAKE ATHABASKA*

By F. J. Alcock
Geological Survey of Canada

Lake Athabaska is the most southerly and the smallest of the three large lakes which drain, by means of the Mackenzie River, into the Arctic Ocean. The general relations of the lake are shown in the diagrammatic map of the Mackenzie Basin, on p. 391. It lies in the physiographic province known as the Laurentian Plateau near the western margin where it borders on the Great Plains. The lake has a length of 205 miles, a maximum width of 35 miles, and an area of approximately 2,850 square miles. Its shore line has a length of over 750 miles; 150 miles longer if the numerous islands be included. The northern shore with its many long, narrow, irregular bays is largely responsible for this excessive length. Here is a youthful shore line produced by the flooding of an uneven land surface.

The southern shore presents a very different set of features. It is dominantly composed of sand beaches resulting from the erosion of the flat-lying beds of Athabaska sandstone which extends along the southern shore of the lake. Back from the shore at the eastern end of the lake the sandstone beds form an escarpment rising in places to a height of 400 feet above the lake. The western half of the southern shore consists of sand beaches, bordered by low sandstone cliffs. Going southward from the lake the ascent is here gradual across a sandy plain to a plateau surface formed upon Athabaska sandstone. On William River the first outcrop of sandstone is encountered 12 miles from the lake. Above this point the ascent is more rapid, the river being marked by short cascades at the edges of outcropping layers of sandstone.

The country surrounding the lake shows the features which are so uniform over the Laurentian Plateau—moderate relief and disorganized drainage. However, the altitude of the upland surface in the neighborhood of Lake Athabaska varies from about 800 feet to 1,300 feet above sea level, a difference of relief which is greater than that shown by much of the plateau. North of the lake the country is a monotonous region of low rocky hills and ridges, separated by depressions which for the most part are occupied by lakes or muskeg swamps. Few of the hills are more than 300 feet in height; they are commonly well rounded on top and are covered with small jack pine, spruce, and poplar. The general trend of the ridges is northeast, and their sides are commonly very steep. This northeast trend is largely due to rock structure. North of the lake both the foliation of the gneisses and the bedding of the Pre-Cambrian sediments have a northeasterly strike, a feature which influenced the preglacial drainage.

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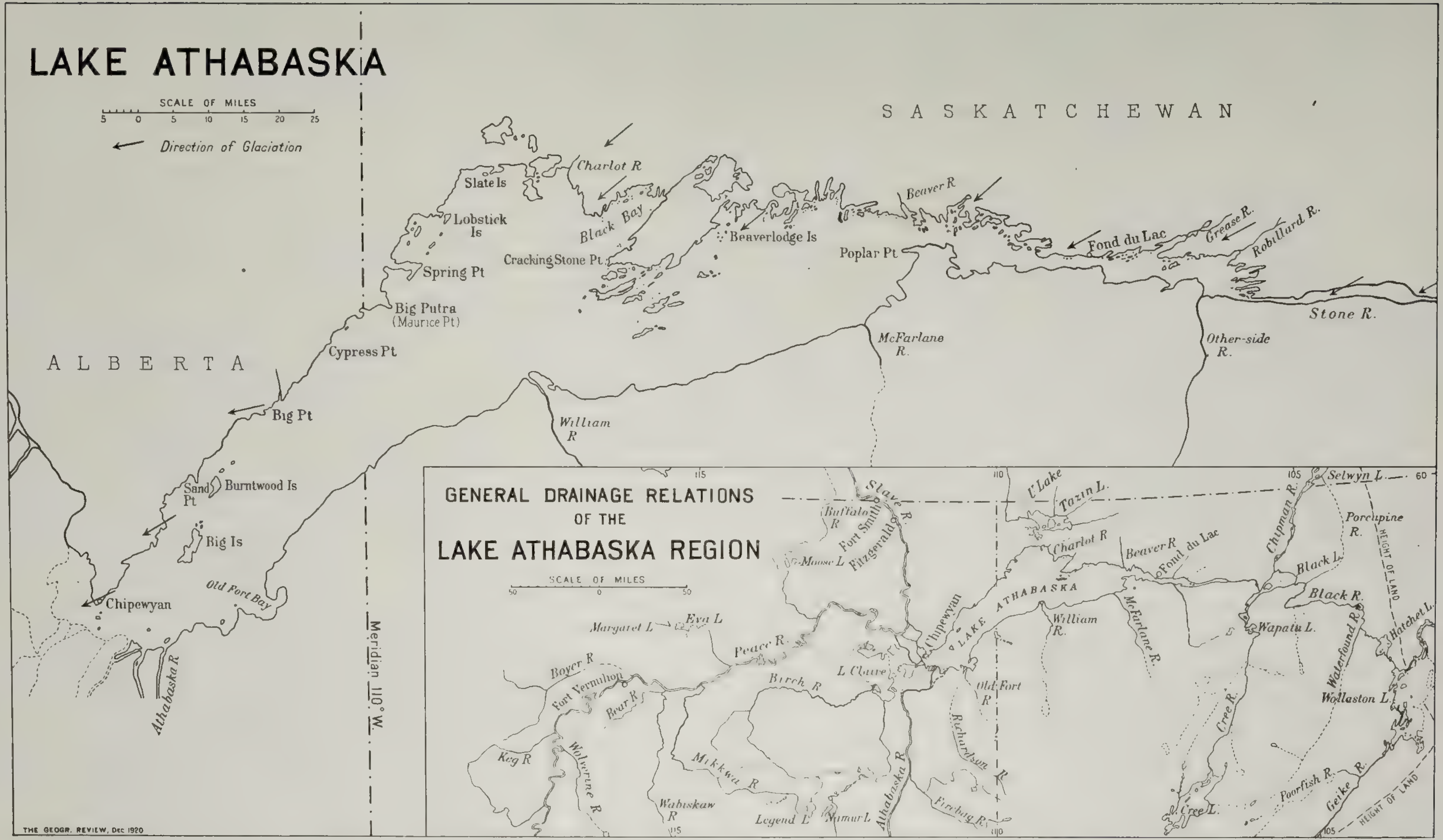

FIG. 1—Outline map of Lake Athabaska. Inset is shown the drainage of the region around the lake. The relation of the lake to the Mackenzie River system as a whole is shown in the diagrammatic map, p. 391.

The present streams of the region, like those of the Laurentian Plateau in general, are marked by lake expansions, rapids, waterfalls, and narrow gorges. Others flow in valleys which are big and wide and out of all proportion to the streams draining them. It is a drainage system which has been completely disorganized by Pleistocene glaciation.

The Origin of Lake Athabaska

A basin of the size of that occupied by Lake Athabaska must be explained as due either to tectonic or erosional forces or both. The best criterion which we can employ as to the applicability of the former lies in the structure of the youngest bed-rock formation of the region, the Athabaska sandstone. This is a clastic formation of wide extent which forms outcrops south of Lake Athabaska and exposures of smaller extent along the northern shore. On the southern shore at the eastern end of the lake it forms cliffs, in places 400 feet in height. It lies in an essentially horizontal position. The outcrops on the northern shore in the immediate vicinity of the lake likewise are flat-lying. The fact that there are no prevailing dips towards the lake on either side points to an absence of control by folding for the formation of the basin. The extreme irregularity of the northern shore and great variations in the width of the basin also suggest a lack of control by faulting.

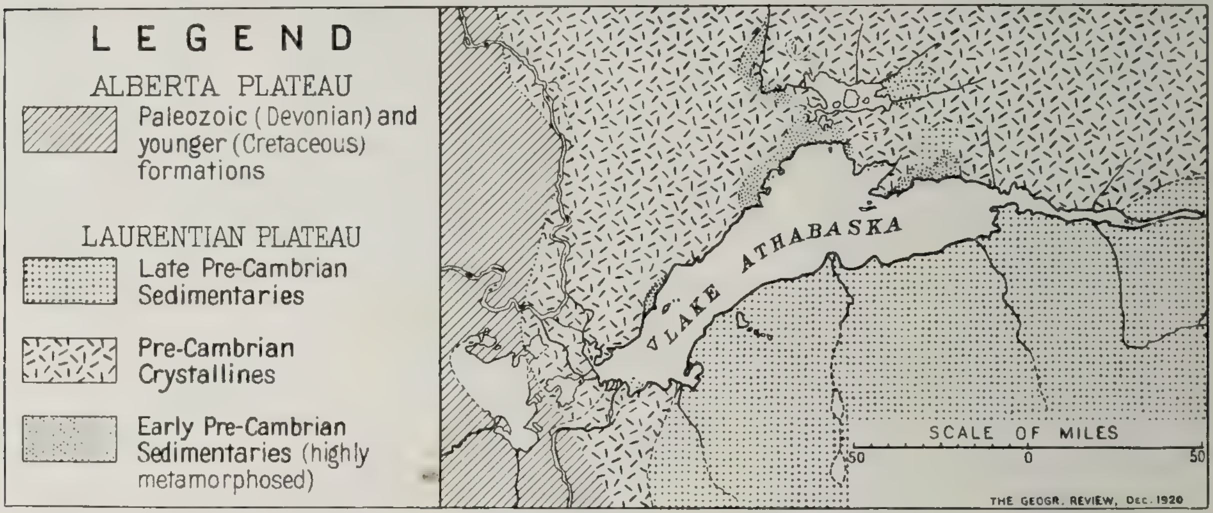
LEGEND
ALBERTA PLATEAU
▨ Paleozoic (Devonian) and younger (Cretaceous) formations
LAURENTIAN PLATEAU
Late Pre-Cambrian Sedimentaries
Pre-Cambrian Crystallines
Early Pre-Cambrian Sedimentaries (highly metamorphosed)
LAKE ATHABASKA
SCALE OF MILES
50
0
50
THE GEOGR. REVIEW, DEC. 1920

FIG. 2—Geological relationships in the Lake Athabaska area (from the Geological Map of the Dominion of Canada, 1913, scale 1:6,336,000, and the map of the Mackenzie River Basin accompanying Geol. Survey of Canada Memoir 108, 1919, scale 1:3,100,000). The lake which lies on the edge of the Laurentian Plateau occupies a glacially eroded depression at the contact of Pre-Cambrian crystallines and late Pre-Cambrian sedimentaries.

It may also be inferred from the character of the preglacial topography that the basin is due to glacial rather than structural control. The present low relief displayed over the Laurentian Plateau is an inheritance from Pre-Ordovician times. A study of the profiles at the base of the Ordovician sediments, which still overlap the Pre-Cambrian rocks in the Hudson Bay-James Bay region and along the southwestern margin of the plateau northwest of Lake Winnipeg, shows that the surface upon which the advancing Ordovician sea deposited its sediments was a clean surface of extremely

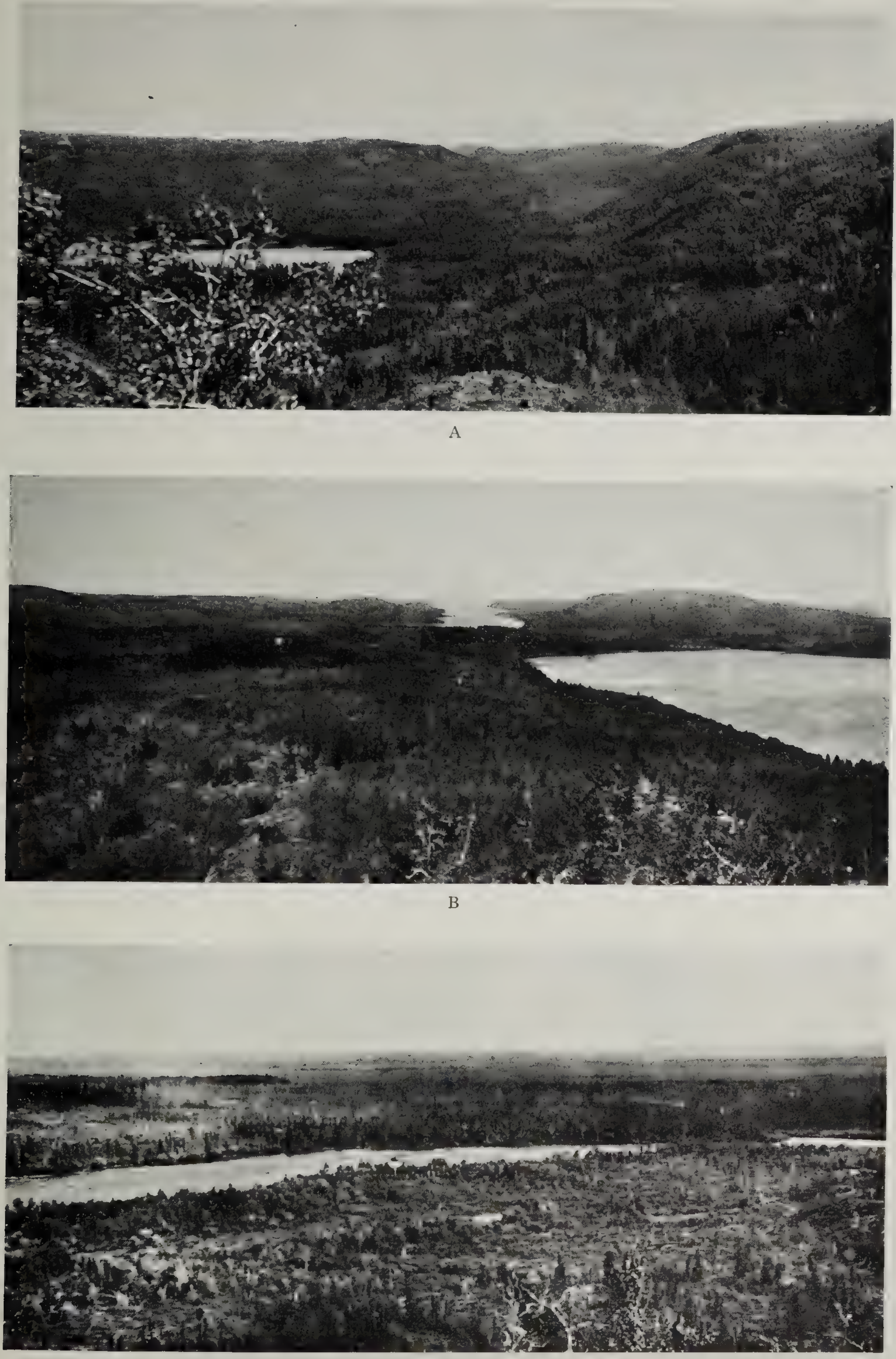

Fig. 3—Characteristic topography in the Lake Athabaska region. A shows the monotonous country of low hills north of Lake Athabaska, B is from Grease Bay on the northeastern shore of the lake, C, the valley of the Stone River east of Lake Athabaska, a topography developed on the flat-lying Athabaska sandstone.

low relief with only minor irregularities. It may be inferred that in Pre-Ordovician times the Canadian shield was base-leveled, and its wide extent suggests that the process was by means of subaerial agencies. In the advanced physiographic stage which the region had attained lakes would be absent, for long before this condition had been reached any lakes would have been drained or filled. Even if part or all of the region was subsequently covered by mantles of Palaeozoic or Cretaceous sediments, the long erosion of Tertiary time would have effected similar conditions. It may be accepted that in preglacial times there was no lake or basin where Lake Athabaska now lies.

It is permissible to conclude, therefore, that the basin of Lake Athabaska is due to glacial causes, either erosional or depositional. It is extremely probable that the main preglacial drainage was much like what it is today. The line separating the Athabaska series from the older rocks on the north very probably marked a wide preglacial valley which drained as now to the Mackenzie. The enlargement of such a valley by glacial erosion or its damming by glacial deposition or a combination of these two factors would most readily explain the formation of the lake basin. No evidence of a morainal dam, however, exists. The western end of the lake is low-lying and is the meeting point of a number of rivers, the Athabaska from the south, the Peace from the west, and the Birch from the southwest—a set of conditions difficult to explain on the theory of a dam.

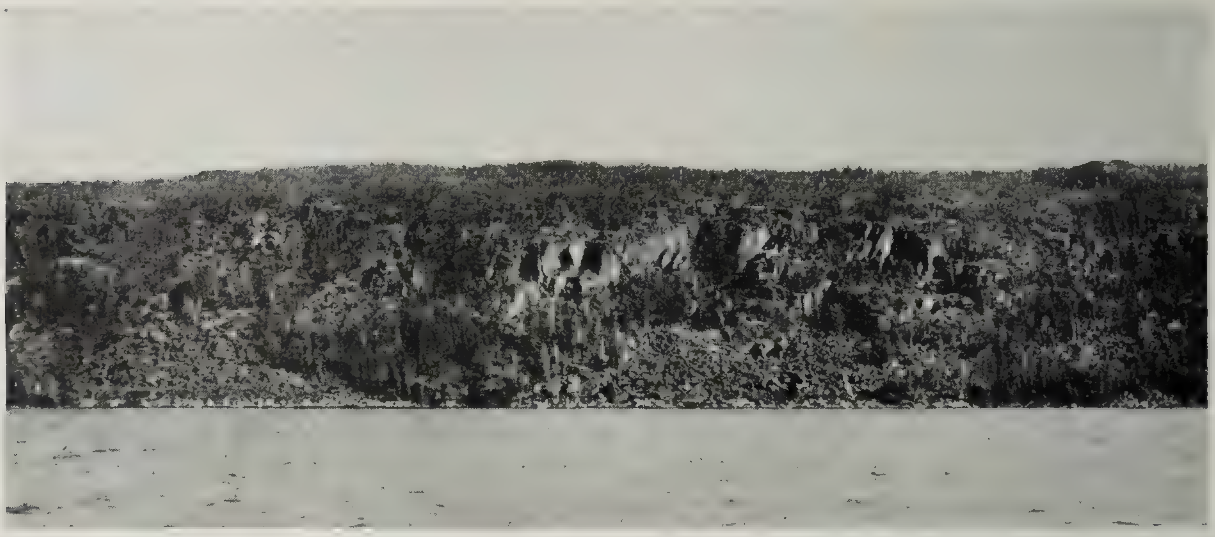

FIG. 4—A typical rock cliff, north shore of Lake Athabaska.

The alternative theory of a basin produced by ice erosion involves the question whether ice is able to erode rock. In the Athabaska region evidence of ice erosion is found in the rounded hills and islands and smoothed sides of channels, where the erosion is by molding and smoothing, and in many definite examples by the plucking of blocks of rock along joint planes. The latter is here probably the most important type of glacial work. A further way in which ice erosion has been accomplished is by the uniting of pot-holes, a process which was definitely located north of Lake Athabaska.

Some of the minor features of the topography of the northern shore also bear on the problem of glacial erosion. The prevailing trend of the embayments is in a northeasterly direction along the line of glaciation. The prevailing trend of many of these narrow bays parallel to the direction of glaciation and their deep V-shaped cross section is strongly suggestive of glacial erosion.

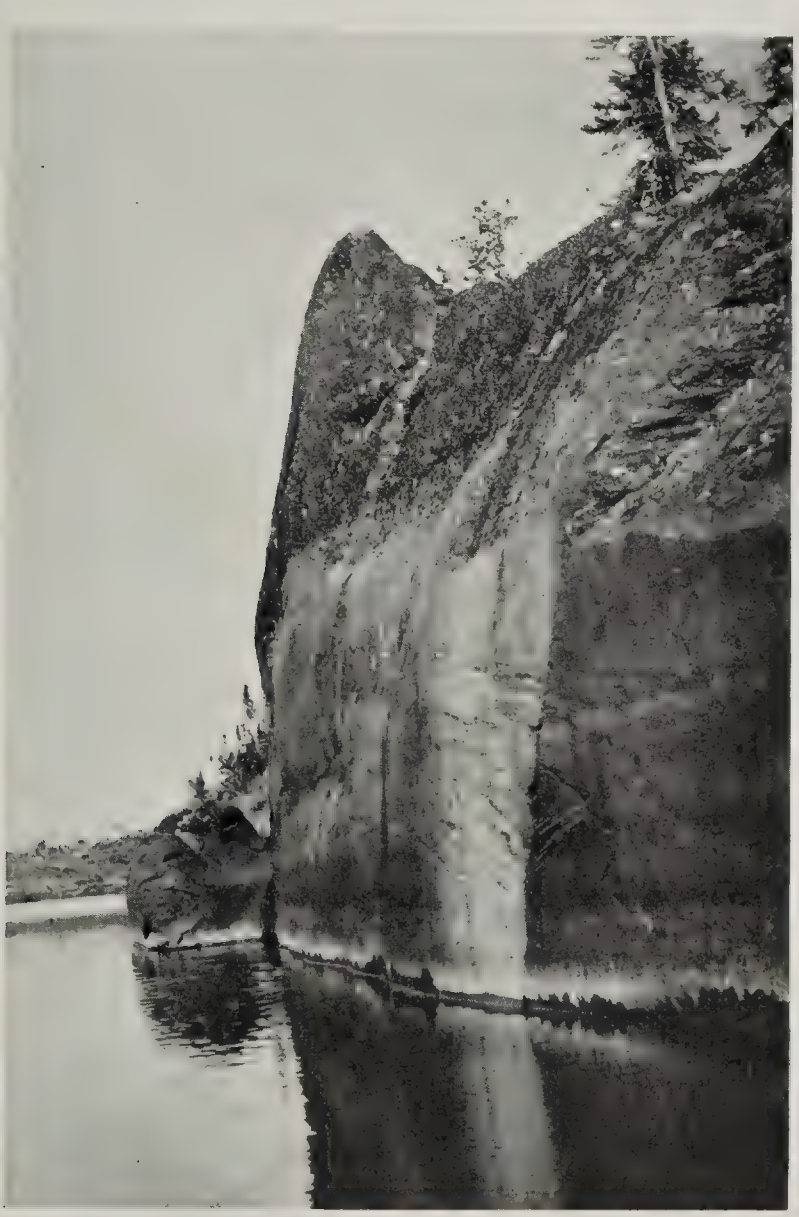

FIG. 5—The glaciated wall of a fiord-like bay, north shore of Lake Athabaska.

The general character of the lake is also significant of its glacial origin. A study of the striation directions plotted on a map of the region shows that the lake is widest and deepest where it lies parallel to the direction of glacial movement. The wide middle and western parts of the lake run in a southeasterly direction, while the narrow eastern part maintains a westerly direction at a considerable angle to the regional glaciation. These facts suggest that the preglacial Stone River flowed where Lake Athabaska now lies, that is, in a westerly direction to about the region of Black Bay and then in a generally southwesterly direction. Where the ice moved directly down the valley the greatest amount of erosion was accomplished.

The amount of erosion which the Pleistocene glaciers accomplished in the valley in which Lake Athabaska now lies cannot be estimated accurately, but that it both widened and deepened the valley is fairly certain. The steep cliffs of sandstone on the southern shore and the equally abrupt cliffs of crystalline rocks on the northern coast in the narrow eastern part of the lake are not features which mark a mature valley in an old age of topographical development, and they can most easily be explained by lateral glacial plucking.

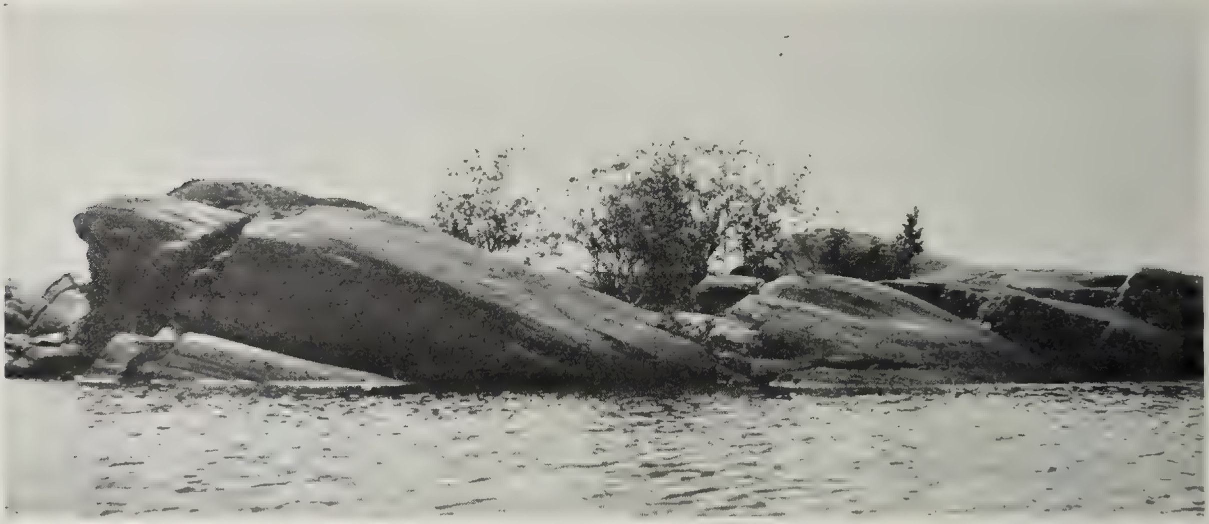

FIG. 6—An illustration of glacial plucking.

To what extent the basin of Lake Athabaska was deepened by glacial erosion involves a consideration of the depth of the lake. In many places the rocky coasts run down steeply under the water, and the impression that one gets is that the lake is deep. The only available record of sounding made in the lake is found on a map of Canada published in 1880 showing the country to be traversed by the Canadian Pacific Railway. At one place in Black Bay the depth is given as 32 fathoms, and at another place the words "no bottom" evidently indicate a considerably greater depth. A depth of 300 feet is probably a conservative estimate for the maximum depth of Lake Athabaska.

The preglacial Stone River certainly did not flow 300 feet below the present level of Lake Athabaska. It probably flowed at or even above the present level of the lake. This may be shown from the streams which empty into the lake. All flow over bed rock at no great distance from their mouths. This is true of the Stone River and all the smaller streams north of Lake Athabaska. The Athabaska River flows over Devonian limestone whose outcrop may be traced along the river to the head of the delta. On the Quatre Fourches Channel the presence of outcrops of granite gneiss shows that bed rock is at but a shallow depth below the river. Again at Fitzgerald on the Slave River, the outlet of Lake Athabaska, an exposure of granite gneiss extends completely across the river, forming a rapid at an elevation of about 80 feet below that of Lake Athabaska. If the latter has a depth, therefore, of 80 feet its basin could not have been produced by a river flowing out down the channel of the Slave River.

It may be concluded that the basin of Lake Athabaska was deepened to the extent probably of 200 feet. How much of this was due to the removal of disintegrated material and how much of it was hard rock is impossible to determine. The general low relief of the region suggests, however, that most of it was hard rock such as is now exposed thereabouts.

As a further test of the validity of the argument of the production of basins by glacial erosion, a study of the other large lakes of the region such as Great Slave Lake and Great Bear Lake might be made. Unfortunately, however, the information regarding these lakes is very meager. In a general way however, they favor the conclusion made for Lake Athabaska. They are not structural basins, as is shown by the general flat-lying nature of the Devonian and Mesozoic strata exposed in places along their shores. Their bays for the most are likewise parallel to the direction of glaciation.

> The evidences of glaciation are well marked around Great Slave Lake. The general course of the striations is southwestward in conformity with the longer diameter of the lake basin, but it varies locally, the movements of the glaciers having adapted themselves to the trend of each bay or channel which approximated to that of the general course followed by the ice.[1]

This has recently been confirmed by A. E. Cameron. Speaking of the northern shores of Great Slave Lake, he says:

> The entire shore line shows clearly the effects of excessive glacial action. Many deep narrow bays stretch inland approximately parallel to one another in a direction about south 60 degrees west (magnetic) or north 80 degrees west (astronomical). That this direction is parallel to the glacial movement is shown by well marked striae on Windy Point.[2]

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[1] Robert Bell: Mackenzie District, *Summary Rept. Geol. Survey of Canada*, 1899, pp. 103 A–110 A; reference on p. 109 A.

[2] A. E. Cameron: Reconnaissance on Great Slave Lake, North West Territories, *Summary Rept. Geol. Survey of Canada*, 1916, Ottawa, 1917, pp. 66–76; reference on p. 69.

THE NEW BOUNDARIES OF HUNGARY

[With separate map, Pl. I, facing p. 410]

The treaty of peace between the Allied and Associated Powers and Hungary was signed at the Grand Trianon, June 4, 1920. The new boundaries of the Hungarian state as defined therein (article 27)[1] are here presented accompanied by a map (Plate I). The map has been prepared in a similar way to that showing the new boundaries of Austria (*Geographical Review*, December, 1919), and it is on the same scale. The boundaries were plotted on the relevant sheets of the Austrian staff map "Generalkarte von Mitteleuropa," 1:200,000, and, where necessary, on the "Spezialkarte der osterreichisch-ungarischen Monarchie," 1:75,000 and then transferred to atlas sheets in 1:750,000 on which the final drawing was made to be reduced to 1:1,500,000 in the engraving.

In the reprinted text each two paragraphs describing a segment of the boundary in the original have, for the sake of clearness, been combined into one throughout, as in our reprint of the Austrian treaty and in that of the Bulgarian treaty (*Geographical Review*, April-May-June, 1920). The spelling adopted is that of the Austrian maps. In the case of discrepancy between the 1:200,000 and the 1:75,000 sheets the latter has been followed.

ARTICLE 27

The frontiers of Hungary shall be fixed as follows (see annexed map):

1. *With Austria:*

From the point common to the three frontiers of Austria, Hungary, and Czecho-Slovakia, this point to be selected on the ground about 1 kilometer west of Antonienhof (east of Kittsee), southwards to point 115 situated about 8 kilometers southwest of St. Johann, a line to be fixed on the ground, leaving entirely in Hungarian territory the Karlburg-Csorna railway and passing west of Kr. Jahrndorf and Wüst-Sommerein, and east of Kittsee, D. Jahrndorf, Nickelsdorf, and Andau;

Thence westwards to a point to be selected on the southern shore of Neusiedler See between Holling and Hidegseg, a line to be fixed on the ground passing south of Pamhagen, leaving in Hungarian territory the entire Einser canal as well as the branch railway running northwestwards from the station of Mexiko, and then crossing Neusiedler See keeping to the south of the island containing point 117;

Thence southwards to point 265 (Kamenje) about 2 kilometers southeast of Nikitsch, a line to be fixed on the ground passing east of Zinkendorf and Nikitsch and west of Német Pereszteg and Kövesd;

Thence southwestwards to point 883 (Trott kö) about 9 kilometers southwest of Kőszeg, a line to be fixed on the ground, passing southeast of Locsmánd, Olmod, and Liebing, and northwest of Kőszeg and the road from Kőszeg to Salamonfa;

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[1] Traité de paix entre les puissances alliées et associées et la Hongrie, protocole et déclaration. Du 4 juin, 1920 (Trianon). xx + 523 pp. [Paris, 1920.] 12½ x 8½ inches. Text in French, English, and Italian. Accompanied, in pocket, by map, 1:1,000,000, showing the new boundaries on a transfer of a section of the Royal Geographical Society's map of Europe on that scale.

Thence southwards to point 234 about 7 kilometers north-northeast of Pinkamindszent, a line to be fixed on the ground passing east of Rohoncz and Nagynarda and west of Butsching and Dozmat, then through points 273, 260, and 241;

Thence in a general southwesterly direction to point 353 about 6 kilometers north-northeast of Szentgotthard, a line to be fixed on the ground passing between Nagysároslak and Pinkamindszent, then south of Karácsfa, Németbükkös, and Zsámand and through point 323 (Hochkogel);

Thence southwestwards to a point to be selected on the watershed between the basins of the Raba (Raab) and the Mur about 2 kilometers east of Toka, this point being the point common to the three frontiers of Austria, Hungary, and the Serb-Croat-Slovene State, a line to be fixed on the ground passing east of Rábakeresztúr, Németlak, and Nagyfalva, west of the Radkersburg-Szentgotthard road and through point 353 (Janke B.).

2. *With the Serb-Croat-Slovene State:*

From the point defined above in an easterly direction to point 313 about 10 kilometers south of Szentgotthard, a line to be fixed on the ground following generally the watershed between the basins of the Raba on the north and of the Mur on the south;

Thence in a southerly direction to point 295 about 16 kilometers northeast of Muraszombat, a line to be fixed on the ground passing east of Nagy dolány, Orihodos with its railway station, Kapornak, Domonkosfa, and Kisszerdahely, and west of Kotormány and Szomoròcz, and through points 319 and 291;

Thence in a southeasterly direction to point 209 about 3 kilometers west of Nemesnép, a line to be fixed on the ground following generally the watershed between the Nemesnepi on the north and the Kebele on the south;

Thence in a south-southeasterly direction to a point to be chosen on the Lendva south of point 265, a line to be fixed on the ground passing east of Kebeleszentmárton, Zsitkócz, Göntérháza, Hidvég, Csente, Pincze, and to the west of Lendva-Jakabfa, Bödeháza, Gáborjánháza, Dedes, Lendva Ujfalu;

Thence in a southeasterly direction, the course of the Lendva downstream;

Then the course of the Mur downstream;

Then to its junction with the old boundary between Hungary and Croatia-Slavonia, about 1½ kilometers above the Gyékényes-Koproncza railway bridge, the course of the Drau (Drave) downstream;

Thence southeastwards to a point to be chosen about 9 kilometers east of Miholjac dolnji, the old administrative boundary between Hungary and Croatia-Slavonia, modified, however, so as to leave the Gyékényes-Barcs railway, together with the station of Gola, entirely in Hungarian territory;

Thence in an easterly direction to point 93 about 3 kilometers southwest of Baranyavár, a line to be fixed on the ground passing north of Torjáncz, Löcs, and Benge and south of Kássád, Beremend with its railway station, and Illocska;

Thence in a northeasterly direction to a point to be chosen in the course of the Danube about 8 kilometers north of point 169 (Kis-Köszeg), a line to be fixed on the ground passing to the west of Baranyavár, Föherczeglak (leaving to the Serb-Croat-Slovene State the railway joining these two places at the junction immediately to the north of Baranyavár), and Dalyok, and to the east of Iván Dárda, Sárok, Udvár, and Izabellaföld (with its railway);

Thence east-northeastwards to a point in the course of the Kigyos about 3 kilometers east-southeast of Bács Madaras station, a line to be fixed on the ground passing between Herczegszánto and Béreg, and then approximately following the course of the Kigyos, but curving to the north of Rigyicza;

Thence east-northeastwards to a point to be selected on the backwater of the Tisza (Theiss) about 5½ kilometers east-northeast of Horgos station, a line to be fixed on the ground passing south of Kun Baya, cutting the Szabadka-Bács Almás railway about 1½ kilometers east of Csikeria station, cutting the Szabadka-Kiskúnhalas railway about 3 kilometers south of Kelebia station, and passing north of Horgos and its station, and south of Röszkeszentmihálytelek;

Thence in a southeasterly direction to the Tisza, the median line of the backwater;

Thence to a point to be selected about 5 kilometers upstream, the course of the Tisza;

Thence in a general easterly direction to a point to be selected on the ground about 4 kilometers southwest of Kiszombor station, approximately east-southeast of point 84 and south-southwest of point 83, this point being common to the three frontiers of Rumania, Hungary, and the Serb-Croat-Slovene State, a line to be fixed on the ground passing between Gyála and Oszentiván and between Óbeb and Kübekháza.

3. *With Rumania:*

From the point defined above east-northeastwards to a point to be selected on the Maros about 3½ kilometers upstream from the railway bridge between Makó and Szeged, a line to be fixed on the ground;

Thence southeastwards, and then northeastwards to a point to be selected about 1 kilometer south of Nagylak station, the course of the Maros upstream;

Thence northeastwards to the salient of the administrative boundary between the *comitats* of Csanád and Arad north-northwest of Németpereg, a line to be fixed on the ground passing between Nagylak and the railway station;

Thence east-northeastwards to a point to be selected on the ground between Battonya and Tornya, this administrative boundary, passing north of Németpereg and Kispereg;

Thence to point 123 (about 1.2 kilometers east of Magosliget), the point common to the three frontiers of Hungary, Rumania, and Czecho-Slovakia (Ruthenian territory), a line to be fixed on the ground passing west of Nagyvarjas, Kisvarjas, and Nagyiratos, east of Dombegyház, Kevermes, and Elek, west of Ottlaka, Nagy Pél, Gyula Varsánd, Ant, and Illye, east of Gyula, Gyula Vári, and Kötegyán, cutting the Nagy Szalonta-Gyula railway about 12 kilometers southwest of Nagy Szalonta and between the two bifurcations formed by the crossing of this line and the Szeghalom-Erdögyarak railway; passing east of Méhkerék, west of Nagy Szalonta and Marcziháza, east of Geszt, west of Atyás, Oláh-Szt.-Miklós, and Rojt, east of Ugra and Harsány, west of Kőrösszeg and Kőrös Tarján, east of Szakál and Berek Böszörmény, west of Bors, east of Artánd, west of Nagy Szántó, east of Nagy Kereki, west of Pelbárthida and Bihar Diószeg, east of Kis Marja, west of Csokaly, east of Nagy Léta and Álmosd, west of Ér-Selind, east of Bagamér, west of Ér-Kenéz and Ér-Mihályfalva, east of Szt.-György-Ábrány and Penészlek, west of Szaniszló, Bere Csomaköz, Fény, Csanálos, Börvely and Domahida, east of Vállaj, west of Csenger-Bagos and Óvári, east of Csenger-Ujfalu, west of Dara, east of Csenger and Komlód-Tótfalu, west of Pete, east of Nagy-Gécz, west of Száraz-Berek, east of Méhtelek, Gárbolcz, and Nagy-Hodos, west of Fertős Almás, east of Kis-Hodos, west of Nagy-Palád, east of Kis-Palád and Magosliget.

4. *With Czecho-Slovakia:*

From point 123 described above northwestwards to a point to be selected on the course of the Batar about 1 kilometer east of Magosliget, a line to be fixed on the ground;

Thence the course of the Batar downstream;

Then to a point to be selected on it below Badaló and near this village, the course of the Tisza downstream;

Thence north-northwestwards to a point to be selected on the ground northeast of Darócz, a line to be fixed on the ground leaving in the Ruthenian territory of Czecho-Slovakia Badaló, Csoma, Macsola, Asztély, and Déda, and in Hungarian territory Bereg-Surány and Darócz;

Thence northwestwards to the confluence of the Fekete Viz and the Csaronda, a line to be fixed on the ground passing through point 179, leaving in Ruthenian territory Mező Kászony, Lónyay tn., Degenfeld tn., Hettyen,[2] Horváthi tn., Komjáthy tn., and in Hungarian territory Kerek Gorond tn., Berki tn., and Barabás;

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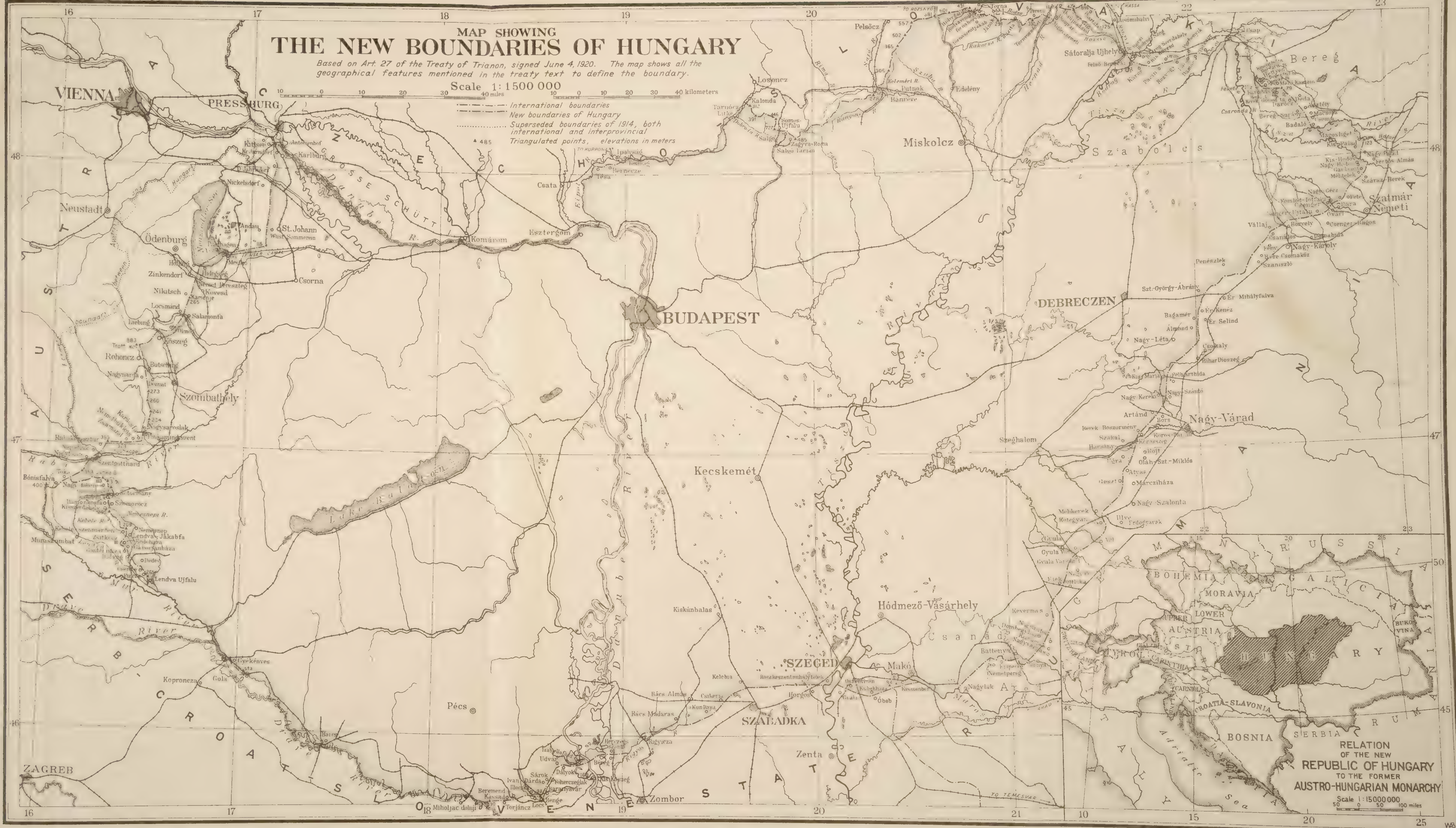
[2] Hetyen on the 1: 200,000 map.

The American Geographical Society of New York

The Geographical Review, Vol. X No. 6, 1920, Pl. I



MAP SHOWING
THE NEW BOUNDARIES OF HUNGARY

Based on Art. 27 of the Treaty of Trianon, signed June 4, 1920. The map shows all the geographical features mentioned in the treaty text to define the boundary.

Scale 1:1500000

Thence to a point to be selected in its course above the administrative boundary between the *comitats* of Szabolcs and Bereg, the course of the Csaronda downstream;

Thence westwards to the point where the above-mentioned boundary coming from the right bank, cuts the course of the Tisza, a line to be fixed on the ground;

Thence to a point to be selected on the ground east-southeast of Tarkány, the course of the Tisza downstream;

Thence approximately westwards to a point in the Ronyva about 3.7 kilometers north of the bridge between the town and the station of Sátoralja Ujhely, a line to be fixed on the ground leaving to Czecho-Slovakia Tarkány, Perbenyik, Örös, Kis Kövesd, Bodrog-Szerdahely, Bodrog-Szög, and Borsi, and to Hungary Damóc, Láca, Rozvágy, Pácin, Karos, Felső Berecki, crossing the Bodrog and cutting the railway triangle southeast of Sátoralja Ujhely, passing east of this town so as to leave the Kassa-Csap railway entirely in Czecho-Slovak territory;

Thence to a point near point 125 about 1½ kilometers south of Alsómihályi, the course of the Ronyva upstream;

Thence northwestwards to a point on the Hernád opposite point 167 on the right bank southwest of Abaujnádasd, a line to be fixed on the ground following approximately the watershed between the basins of the Ronyva on the east and the Bozsva on the west, but passing about 2 kilometers east of Pusztafalu, turning southwestwards at point 896, cutting at point 424 the Kassa-Sátoralja road and passing south of Abaújnádasd;

Thence to a point to be selected on the ground about 1½ kilometers southwest of Abaújvár, the course of the Hernád downstream;

Thence westwards to point 330 about 1½ kilometers south-southwest of Perény, a line to be fixed on the ground leaving to Czecho-Slovakia the villages of Miglécznémeti and Perény, and to Hungary the village of Tornyosnémeti;

Thence westwards to point 291 about 3½ kilometers southeast of Jánok, the watershed between the basins of the Bodva on the north and the Rakacza on the south, but leaving in Hungarian territory the road on the crest southeast of Buzita;

Thence west-northwestwards to point 431 about 3 kilometers southwest of Torna, a line to be fixed on the ground leaving to Czecho-Slovakia Jánok, Tornahorváti, and Bódvavendégi, and to Hungary Tornaszentjakab and Hidvégardo;

Thence southwestwards to point 365 about 12 kilometers south-southeast of Pelsőcz, a line to be fixed on the ground passing points 601, 381 (on the Rozsnyó-Edelény road), 557, and 502;

Thence south-southwestwards to point 305 about 7 kilometers northwest of Putnok, the watershed between the basins of the Sajó on the west and the Szuha and Keleméri on the east;

Thence south-southwestwards to point 278 south of the confluence of the Sajó and the Rima, a line to be fixed on the ground, leaving Bánréve station to Hungary while permitting, if required, the construction in Czecho-Slovak territory of a connection between the Pelsőcz and Losoncz railway lines;

Thence southwestwards to point 485 about 10 kilometers east-northeast of Salgó Tarján, a line to be fixed on the ground following approximately the watershed between the basins of the Rima to the north and the Hangony and Tarna rivers to the south;

Thence west-northwestwards to point 727, a line to be fixed on the ground leaving to Hungary the villages and mines of Zagyva-Róna and Salgó, and passing south of Somos-Ujfalu station;

Thence northwestwards to point 391 about 7 kilometers east of Litke, a line following approximately the crest bounding on the northeast the basin of the Dobróda and passing through point 446;

Thence northwestwards to a point to be selected on the course of the Eipel (Ipoly) about 1½ kilometers northeast of Tarnócz, a line to be fixed on the ground passing through point 312 and between Tarnócz and Kalonda;

Thence southwestwards to a point to be selected in the bend of the Eipel about 1 kilometer south of Tesmag, the course of the Eipel downstream;

Thence westwards to a point to be selected on the course of the Eipel about 1 kilometer west of Tésa, a line to be fixed on the ground so as to pass south of the station of Ipolyság and to leave entirely in Czecho-Slovak territory the railway from Ipolyság to Csata together with the branch line to Korpona (Karpfen), but leaving Bernecze and Tésa to Hungary;

Thence southwards to its confluence with the Danube, the course of the Eipel downstream;

Thence to a point to be selected about 2 kilometers east of Antonienhof (east of Kittsee), the principal channel of navigation of the Danube upstream;

Thence westwards to a point to be selected on the ground about 1 kilometer west of Antonienhof (east of Kittsee), this point being common to the three frontiers of Austria, Hungary, and Czecho-Slovakia, a line to be fixed on the ground.

A summary statement and estimate of the territorial, ethnic, and economic changes in the Hungarian State as defined by these new boundaries is given in the note on p. 415 of this number of the *Review*.

GEOGRAPHICAL RECORD

NORTH AMERICA

The Southern Red Hills of Alabama: A Study in Geographical Contrasts. The variation of human relations with the variation in physical conditions of a region is nicely illustrated by Roland M. Harper in the paper "Some Relations Between Soil, Climate, and Civilization in the Southern Red Hills of Alabama" (*South Atlantic Quarterly*, July, 1920). The southern red hills region, a division of the Coastal Plain of the southeastern United States, stretches from South Carolina to Mississippi as a red loamy belt contrasting strongly in its topography with the level sandy belts nearer the coast and bearing superficially a resemblance to the Piedmont (compare the map, Fig. 5, p. 380, and the diagram, Fig. 7, p. 383, illustrating the article by H. F. Cleland on "The Black Belt of Alabama"). In Alabama there is a somewhat pronounced contrast between the eastern and western sections of the belt itself. The east presents broad upland stretches cut by narrow swampy valleys. In the west dissection has proceeded further; the divides are reduced to narrow ridges, the valleys are broad. There also exists a climatic difference dependent on the progressive retardation of summer rains as one goes east from the Great Plains to Florida. In the western red hills the rainfall from April to June exceeds that from August to October. In the east the reverse is the case. Thus Pushmatcha, near the western edge of the state, has an excess of early summer rainfall over that of late summer amounting to 5 inches. Eufala, on the eastern edge, has an excess of 1.5 inches in the reverse direction. Associated with this is a variation in soil fertility. Apparently the warm rains of late summer exercise a more efficient solvent action, leaching out the agronomically valuable mineral salts to a greater extent. With other factors this combines to give the advantage of soil fertility to the western section. That this is the case is well shown in the natural vegetation; thus the much greater abundance in the west of the sweet gum, a tree flourishing on the richer soils.

It is principally the advantage of soil fertility that is reflected in the earlier development of the western section of the red hills, though in some degree it may be attributed to greater accessibility. In 1820 the population of the western section was 4.7 to the square mile to 1.1 in the eastern section. Just before the Civil War the ratios were 11.5:7.3. It was not until the last decade of the century that the extension of railroads and the use of commercial fertilizer turned the balance in favor of the east with its smoother topography and lighter soils.

Today in percentage of land in farms, in area of improved land; in size of farms; in value of land, of farm property, of crops the east is superior to the west. But in dealing with these statistics it must be remembered that one is dealing with a region occupied by two races in unequal proportions. The early development of the western red hills was particularly associated with cotton cultivation and slave labor. In 1850 the whites in the western section formed only 47 per cent of the population against 83 in the east (in 1910 the ratios were 37:68). In *ante bellum* days the eastern section had no large plantations. Associated with this is a condition which Harper has elsewhere shown obtains generally in the South where the negro population exceeds that of the white (see the note "The Culture of the Southern States," *Geogr. Rev.*, Vol. 8, 1919, pp. 274–275). Among the white population of such regions the standard of living is comparatively higher than that among their neighbors where the negro is in the minority. Thus the illiteracy figure for the white population of the western red hills is 7.6 per cent against 13.1 per cent in the eastern red hills. In 1910 in the west the white farmer cultivated nearly twice as much land as his colored neighbor, and he lived in a house worth four times as much. In the east the land cultivated by white and negro farmers was about equal, while the value of the house of the former was about twice that of the latter. (Further details are given by Harper in "Resources of Southern Alabama," *Geol. Survey of Alabama Special Rept. No. 11*, 1920.)

And so in other relations contrasts are seen between these two sections of Alabama. As a whole the study is noteworthy in that it shows the importance of a geographical evaluation of census statistics.

Geographical Conceptions of a Primitive People: Yurok Geography. The Yurok Indians live in scattered settlements along the lower reaches of the Klamath River of northwestern California and for a distance of forty-two miles up and down the coast on either side of the river mouth. In "Yurok Geography" (*University of California Publications in American Archaeology and Ethnology;* Vol. 16. No. 5, 1920) T. T. Waterman gives an account of the geographic ideas of this primitive people and of the geographic conditions of their life.

Yurok cosmography is refreshingly naïve and childish; like most early people, these Indians think the earth is circular and surrounded by the ocean. The Klamath rises in the salt water to the east and cuts across the world, the center of which would seem to be a point near the confluence on the Klamath with the Trinity.

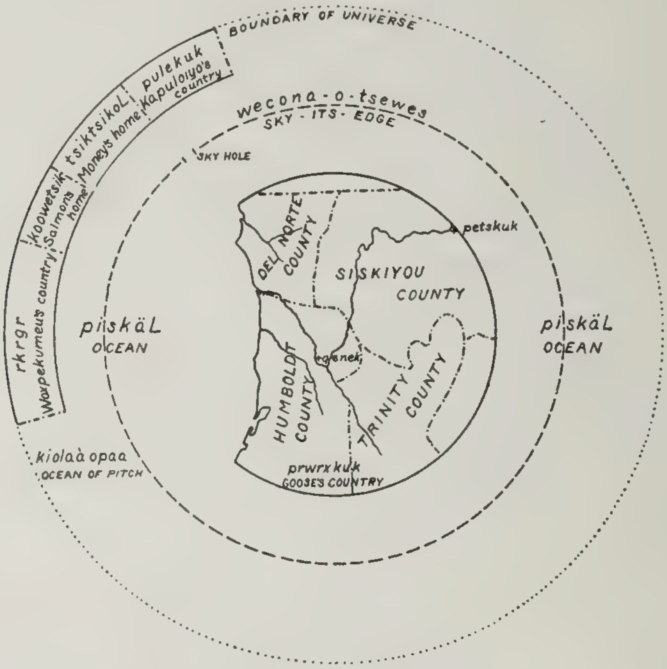


FIG. 1—Diagram illustrating the Yurok idea of the world. Reproduced from Figure 1 of the article cited in the text.

The Pacific bounds the land to the west, and one reaches the ocean in Humboldt County, Siskiyou County and southern Oregon to south, east, and north respectively. Not many miles beyond, the dome of the sky—pierced by a hole through which the wild geese fly—comes down to the waters. One can pass beneath the edge of the sky and reach a variety of mysterious regions on the western border of the universe.

The Yuroks do not express directions in terms of the heavenly bodies or of the compass; the river being an essential feature of their life, their fundamental conceptions of direction are *pets* and *pul*, or "up river" and "down river;" and, as the Klamath where it enters the sea is flowing from the southeast, *pul*, or "down stream" is applied also to a northerly direction along the coast.

Waterman is of the opinion that "local geography seems to mean rather more to the Yurok than is ordinarily the case with Indian tribes." They have certainly given place names to innumerable localities and objects on their frequented ways of seacoast and river bank. Practically every boulder has its name and every stack of rock offshore or on the beach. On the other hand, large hills or even mountains in the back country are unnamed. Moreover the Klamath itself bears no distinctive title, probably because it enters so vitally into everyday life and thought.

Yurok "towns" are all very small, the largest one containing only twenty-five houses. They are mainly found along the streams and seashore. The ones on the river show a marked favoritism for the northern or sunny bank. A certain quarrelsomeness and disposition to engage in feuds was responsible for the founding of many "towns" by persons who, for a variety of reasons, desired to sever relations with their old homes.

EUROPE

The New Frontiers of Hungary. The treaty signed at the Grand Trianon (see this number of the *Review*, p. 408) has left unrecognizable the old Hungary, "Kingdom of a Thousand Years." The new boundaries, which have less than half their former length, do not touch the old ones at any point. Only is there coincidence in part with the old internal frontier between Hungary proper and Croatia-Slavonia. The boundary with Czecho-Slovakia is approximately 375 miles in length; that with Rumania 180 miles; with Yugo-Slavia 340 miles; with Austria 125 miles. Formerly distinguished by their predominantly "natural" character—river or mountain crest—the present boundaries are almost entirely conventional. They enclose an area of approximately 35,000 square miles against the former area of 125,600 square miles and a population of approximately 7,500,000 (210 per square mile) against a former population (census of 1910) of 20,886,447 (165 per square mile).

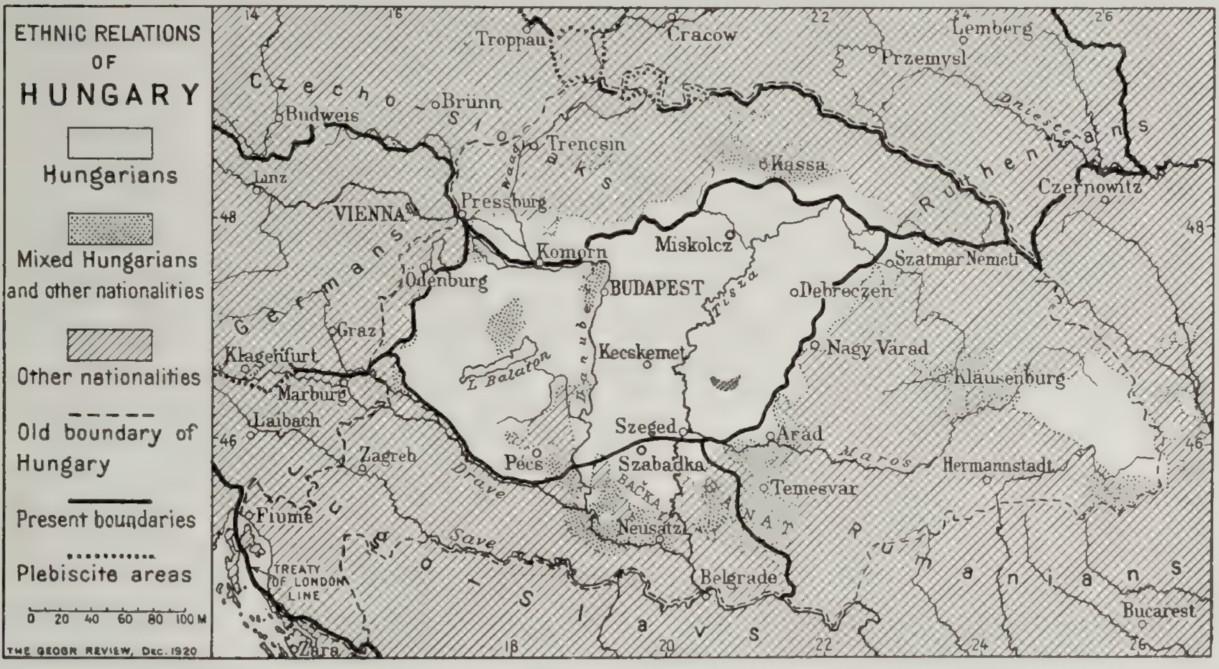


FIG. 1—Map showing the ethnic relations of the new Hungary. Scale approximately 1:10,000,000.

Drawn in general on the principle of nationality the new boundaries make certain departures on strategic and economic grounds (L. Eisenmann: La nouvelle Hongrie, *Ann. de Géogr.*, September, 1920).

The old Hungarian Kingdom was approximately half Magyar; the new state is almost purely Magyar. The chief non-Magyar element is to be found in the German enclaves west of the Danube; there are also a few islets of Slav population as for instance in the Pécs region. Hungary, however, has probably lost some 2,000,000 of her nationals. The 600,000 Szeklers of Transylvania are irretrievably separated from their *confrères* by a solid block of Rumanian population 120 kilometers broad. East of Debreczen the Magyar population stretching out to the foothills of the Bihar has gone to Rumania with the railroad from the Czecho-Slovakian frontier to Nagy Szalonta, and Rumania also gets the important railroad junction of Arad. In the Bačka is Szabadka (Subotica) with a large Yugo-Slav population (50,000) awarded to the Serb-Croat-Slovene State with the territory to the south, though thereby the transfer of three times as many Magyars is involved (The New Frontiers of Hungary, *The New Europe*, January 15, 1920). There are more than half a million Magyars in Czecho-Slovakia. The Hungarian loss here includes the ancient capital, Pressburg (Bratislava), whereby the Slav state gains the necessary outlet on the Danube. It is principally strategic reasons that extend the riverine frontier to Gran. Eastward a strip of Magyar population is also included in Czecho-Slovakia, giving the new state uninterrupted rail communications with Rumania.

Another ethnic change, more significant than the numbers alone suggest, is the increased proportion of the Jewish element—5 to 7 per cent. The Jews have played an important part in the financial and professional life of Hungary, and their increased preponderance intensifies an old problem.

Hungary has always been an agricultural state. The new boundaries impose upon her a still more exclusively agricultural character, though she has lost some of her best crop producing areas, notably the maize and wheat lands of the Bačka and the Banat and the barley and sugar beet fields and rich pastures of the Little Alföld north of the Danube (compare B. C. Wallis: The Peoples of Hungary: Their Work on the Land, *Geogr. Rev.*, Vol. 4, 1917, pp. 465–481). Compared with the old capacity it is estimated that the new territory will produce the following percentages: rye, 62; barley, 47; wheat, 40; maize, 27; hay, 29; potatoes, 41; beets, 37; wine, 62. The change of régime, however, is favorable to agricultural development. In particular one may look for a breaking up of the *latifundia* about Lake Balaton, an area which has always contributed largely to the emigration movement. The sheep of Transylvania, the cattle and sheep of Slovakia and Ruthenia, and a well developed cattle industry along the late Austrian frontier are also lost to Hungary. The percentage productive capacity in respect to live stock is thus estimated: cattle, 31; sheep, 26; pigs, 44; horses, 40. The two latter, however, will suffer the loss of the maize fields and pastures of the Bačka and Banat.

In 1890, of the Hungarian population gainfully employed 71 per cent was engaged in agriculture; 12 per cent in industry. In 1910 the numbers were 62 and 17. This was the result not only of natural progress but of a well defined state policy, political as well as economic. The urban centers were the focus of magyarization. But with the loss of the bordering hill country Hungary lost her chief industrial resources. In 1913 Hungary mined 20,500,000 quintals of iron ore. Her present productivity is estimated at one-fifth; the important mines of the north (in Gömör) and the southeast (in Hunyad and Krasso-Szörény) are lost and also the salt mines of Máramaros and those of Transylvania. On the other hand most of the carboniferous deposits remain. With the exception of the Pécs basin, containing reserves estimated at 110,000,000 tons, these fuel resources are of no great significance; the lignite beds of the Bakony near Budapest are approaching exhaustion. As it was before the war Hungary imported about one-third of her coal requirements. Poverty in coal was partly compensated by resources in water power and natural gas—forces whose exploitation was just beginning. Even more serious is the loss of the forests, of which it is estimated only 17 per cent remain, including 6.5 per cent of the coniferous forests.

Hungary loses several industrial towns, and others in the Magyar country which—thanks particularly to the policy of railroad development (Hungary had a greater mileage per unit population than Germany)—easily received their raw materials from the mines and forests are cut off from sources of supply. Discounting the latter circumstance, however, and assuming that other conditions remain as before, the industrial capacity of the new Hungary as compared with the old is estimated thus: metallurgy, two-fifths; weaving and spinning of cotton goods, one-quarter; of linen, one-half; of jute, three-quarters; of wool, one-tenth; tanneries, one-half. The agricultural industries are somewhat more favorably placed: flour mills, three-fifths; sugar refineries, two-fifths; distilleries, one-half; tobacco factories, one-half. The working population is likewise placed at about two-fifths of its former magnitude.

Budapest has figured to an abnormal degree in the industrial life of the nation. It seems inevitable that for a time at least this city of nearly a million in an agricultural state of less than 8,000,000 must show some decline. Compared with Vienna, however, the situation of Budapest is greatly superior. As a capital city Budapest remains most advantageously placed.

AFRICA

Mauritius and Réunion. Though conquered from France by Great Britain in 1810 and forming a part of the British Empire ever since, Mauritius has always been the home of a people French in language, traditions, and sympathies. Particularly since the armistice of 1918, but also before, a "retrocessionist" movement has been aggressively fostered by the creole leaders who have argued with skill and plausibility that not only the interests of the islanders but those of the British Empire as a whole will be served if only Great Britain can bring herself to perform the *geste élégant* of restoring the old "Île de France" to its original mother country. As a result of this movement, public attention in France has recently been directed towards Mauritius and its French neighbor, Réunion. Incidentally to the propagandist purpose for which they were written, two recent articles on this subject furnish us with important geographical details. Especially noteworthy is the description and comparison of Réunion with Mauritius by P. Carié in the May, 1920, number of *La Géographie,* but H. de Rauville's article in *Colonies et Marine* for June 30, 1920, is also a valuable study, though more political and historical in character and mainly devoted to proving how very French the Mauritians are.

Both islands are volcanic. In Réunion the cycle of erosion has not progressed as far as in its sister isle, the terrain is more mountainous, and consequently the cultivated area less extensive and the population less numerous, although the island itself is somewhat larger. The greater range of altitudes is partially responsible for a large diversity in the kinds of crops raised, whereas in Mauritius practically all the cultivable soil is given over to sugar cane.

There are three main classes of society in Réunion: the indolent African negroes, the so-called "little whites," and the upper class of business and professional men. The second is by far the most interesting and individual; composed largely of the descendants of seventeenth century French refugees from Madagascar this people earns a livelihood by carrying on small handicrafts and agriculture on a limited scale. Many individuals from the upper class have made a name not only in their native island, but also in France, and even Mauritius, though owing allegiance to Great Britain, has contributed not a few distinguished scientists, doctors, artists, lawyers, and soldiers to the service of the French nation.

The greatest obstacle in the way of the prosperity of Réunion has been the lack of cheap labor. The African element is too lazy and unreliable to be worth much, and emigration of Hindus from India to this French island has not been permitted for many years. Mauritius, on the other hand, was until 1907 open to Indian immigration, and there the Hindus and their children have been an invaluable resource (Indians formed 70 per cent of the population according to the 1911 census). Réunion furthermore suffers from the lack of a good harbor, whereas Mauritius rejoices in two fine ports. In addition, Carié claims that the free institutions of Réunion—the right of universal suffrage and more particularly the privilege of electing colonial representatives who sit in Paris—as compared with the deadening "administrative tyranny" of Mauritius, tend to make politics play altogether too important a part in everyday life. "La manne électorale, chez les Africains et chez beaucoup de petits blancs, remplace agréablement le travail." Though hardly venturing to do more than hint at the remedies that should be taken to do away with this evil, he suggests that for colonial representation some form of colonial home rule should be substituted and dreams of the ultimate formation of a *bloc français* in the Indian Ocean composed of Madagascar, Réunion, and Mauritius.

POLAR REGIONS

A Note on "Eskimo Stone Rows in Greenland." The stone monuments recorded by Porsild in the November number of the *Review* are very remarkable. As far as I can discover, there is no mention of hopping-stones, or of any hopping game, from any other Eskimo area, although the word *nangerpoq* "he hops," is known in Labrador and Hudson Bay. The game described by Porsild must surely have originated in western Greenland.

The stone fence at Saputit is also, I believe, without a parallel in Arctic America. It is true that hunting fences are mentioned by several explorers, but what they meant were lines of single stones, or sods of earth, or occasionally sticks and stumps of wood, set up at intervals of from 20 to 40 yards from one another. As a rule two such rows are erected, one on either side of a valley in which caribou are grazing. The women and children then drive the deer down between these lines, (which appear to the frightened game like the heads of hunters), either into a lake, where the men are waiting in their kayaks to spear them in the water, or else through a narrow gap where the hunters, armed with bows and arrows (nowadays often with rifles), shoot at them from the concealment of hollows and shallow pits. Old alignments of this nature are found everywhere from Alaska to Hudson Bay, and new ones are constantly being erected even now by the Eskimos around Coronation Gulf. The traveler will often find in their vicinity small circular or semicircular stone shelters where the hunters have lain in wait, and stone cairns where they have cached their meat. But true fences of stone have never been recorded outside of Greenland, unless one includes the low dams that block the mouths or outlets of the salmon creeks.

D. Jenness

MATHEMATICAL GEOGRAPHY

A Famous Seventeenth Century Map of Italy. The early seventeenth-century Paduan geographer and astronomer G. A. Magini compiled a large atlas of Italy, which was completed in 1604 though not published until 1620, after his death. In the latter year his son Fabio brought out this great monument of cartography consisting of no less than sixty detailed maps. The atlas, however, did not include a general map of the peninsula, the existence of which is indicated in documents concerning the Magini, and in a vain search for a copy of which many libraries had been ransacked, until about three years ago, when Professor R. Almagià of the University of Rome was fortunate enough to discover one. This forms the subject of a brief article in the March-April (1920) number of *L'Universo* (a new periodical issued by the Istituto Geografico Militare of Florence), and to it Professor Almagià intends to devote a more extensive discussion in a proposed work on the cartography of Magini.

The general map bears the title "Italia Nova di G. A. Magini." Drawn from data which had been used in making the Atlas, it was not published until 1608 on account of difficulties in securing the services of an engraver. Within its ample dimensions (115.5 x 89 centimeters), it depicts the whole of Italy and the shores of the Adriatic, but only the northeastern corner of Sicily, and that, together with southern Sardinia and the tip of Calabria, in a state damaged beyond recognition. On the undamaged parts of the map the wealth of detail is extraordinary both in place names and in the representation of river systems; the principal chains of Alps and Apennines are also shown, together with political boundaries of two grades of importance.

Magini, through his connections with Francesco Gonzaga, prince of Mantua and Montferrat, and with other influential persons at the courts of Italy, undoubtedly had access to unpublished official and private documents. By the use of these materials he was enabled to compile a map superior to those of all of his contemporaries. Reproductions of his "Italia Nova" are now very rare though there are in existence a few which were published at later dates and with slight modifications of the original. On the other hand, as Almagià explains, the data contained in the map "reduced and simplified for the purposes of convenience but without any noticeable improvement and without bearing the author's name, entered into many of the famous foreign atlases like those of Hondius, Blaeu, Janson, Visscher and Seuter. In this way the map exerted an immense influence on the cartography of the sixteenth century, and, recognized probably by all as the best product of its epoch, enjoyed for about a century a well-earned fame."

PHYSICAL GEOGRAPHY

The Growth and Needs of Oceanography. This year for the first time in the history of the British Association the presidential address was delivered by an oceanographer (*Nature*, August 26, 1920, and *Science*, September 3, 1920). It is fitting, therefore, that Dr. Herdman prefaced the main theme of his speech by a sketch of the growth of this "youngest of sciences." For, according to the veteran oceanographer Buchanan, it was born "a little to the westward of Teneriffe on February 15, 1873," with the first oceanic sounding of the *Challenger*. To Buchanan's story "A Retrospect of Oceanography in the Twenty Years Before 1895," retold in his second collection of essays "Accounts Rendered of Work Done and Things Seen" (1919), Herdman adds comment on the preliminary work leading up to the first deep-sea expedition and in its most notable successors whereby in a comparatively short space of time "we know the distribution of temperatures and salinities over a great part of the surface and a good deal of the bottom of the oceans, and some of the more important oceanic currents have been charted and their periodic variations, such as those of the Gulf Stream, are being studied. We know a good deal about the organisms floating or swimming in the surface waters (the epiplankton), and also those brought up by our dredges and trawls from the bottom in many parts of the world although every expedition still makes large additions to knowledge."

The field of oceanography, which is described as of a peculiarly "annectant" character, has broadened to a vast range of problems. Many of these have an unusual interest for the layman because of their practical bearing. Take for instance the study of deep-sea deposits commenced by Murray on the *Challenger*. Among the results of Murray's researches was the discovery of phosphate rock off Christmas Island (south of Java)—a discovery which has already brought the British government a revenue exceeding the total cost of the *Challenger* expedition.

During the war knowledge of the chemistry and physics of the ocean—of salinity and currents—proved of great value in regard to submarine operations and drifting mines (see note below, "The Drift of Mines in the North Atlantic"). In his outline of problems before the science of oceanography Herdman however confines himself to the biological side . . . "the ultimate causes of variations in the abundance, in the sizes, in the movements, and in the qualities of the fishes of our coastal industries." Alike from the extensive and the intensive points of view this dominantly economic side of oceanography—the ocean as a food reserve—is in need of investigation. New fishing grounds await discovery. In the discussion following the presidential address there was instanced the case of the vast shallow water area (under 100 fathoms), extending from around the Falkland Islands to Montevideo, of which our knowledge is limited to the results of eight trawling records, two by the *Challenger*, six by the *Albatross*. It is needless to comment on the limited knowledge of the controls governing fluctuations of the sea harvests in our old established fishing grounds. There is the spectacular case of the tilefish which was discovered off Nantucket in 1879, disappeared in a wholesale destruction in 1882, and lately reappeared in numbers sufficient to maintain an important fishery. The responsible factor is held to be changes in temperature due to changes in régime of the currents, whence arises the practical question of the frequency of such changes.

The Drift of Mines in the North Atlantic. The oceanographical essays of Buchanan to which reference has been made above ("Accounts Rendered") include a description of one of the notable events in the history of oceanography—the establishment of the Oceanographical Museum of Monaco and an appreciation of the work of its founder, the Prince of Monaco. Perhaps the best known phase of this work is the series of observations on the currents of the North Atlantic based on the methodical dispersion of floats from the *Hiron-*

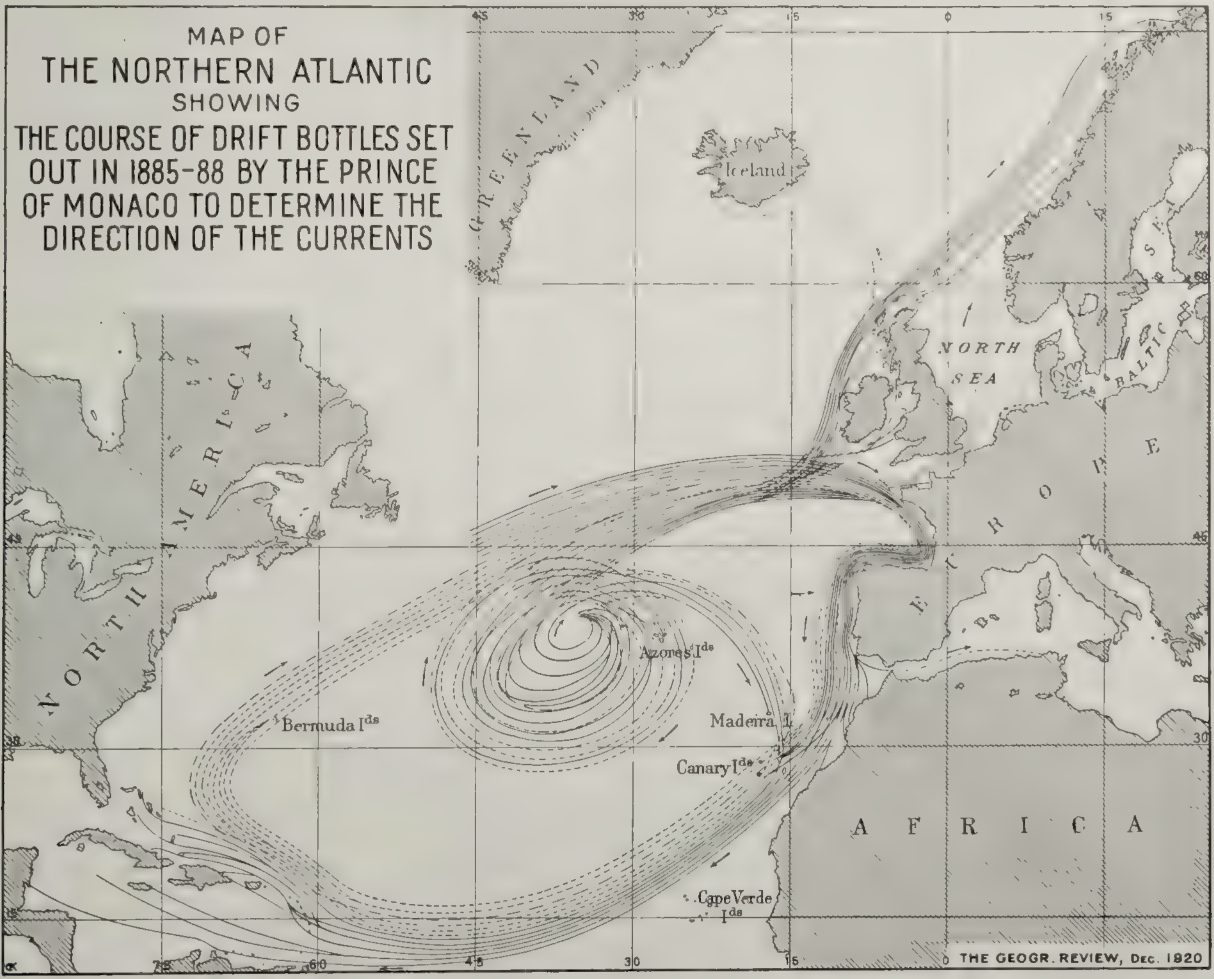


Fig. 1—Map illustrating the courses of drifting mines in the northern Atlantic.

delle during the years 1885–1888. A recent practical result is the application to the break-up of the mine fields sown during the war in the waters of western Europe.

In general the drifting mines will follow definite courses whose routes are shown on the accompanying map (S. A. S. Albert, Prince of Monaco: Marche des mines flottantes dans l'Atlantique Nord et l'océan Glacial pendant et après la guerre, *Bull. l'Inst. Océanogr. No. 357,* 1919). Mines strewn in the northern waters (the North Sea and off western Britain) will be carried to the Norwegian fiords. In conjunction with the action of tides and storms in the narrow English Channel the course of mines is here more variable; of those not washed to either shore some will travel northward and others will join with those from off the western coast of France, Spain, Portugal, and Morocco. These enter into the great oceanic circulation drifting to the West Indies, and pass into the Gulf Stream to be lost in the circulation of the Sargasso Sea or to return, after a period estimated at about four years, to the mouth of the English Channel.

At certain points there will be a tendency to concentration of drifting mines. Such danger zones are the Gulf of Gascony between Bordeaux and Cape Finisterre; the western coast of Portugal and that of Morocco; the Canaries and Madeira; the Azores.

The Beauty of Geographical Features. The annual address of the President of the Royal Geographical Society, Col. Sir Francis Younghusband, is noteworthy for its appeal to the emotions rather than to the understanding, or perhaps to the emotions through the understanding (*Geogr. Journ.*, July, 1920). He holds that the beauty of the face of the earth is more worth "learning about, knowing, and understanding" than any other phase of geographical science. Younghusband's career as an explorer of innermost Asia and Tibet, and as administrator of Kashmir has given him an extensive knowledge of an overlarge continent, and his reports concerning places and peoples have been of much importance to the British government; but he regards his knowledge of the beauty of the mountains, plateaus, plains, and valleys in that vast region as "most worth having" and of "most geographical value." He urges, furthermore, that the beauty of a landscape should not only be enjoyed by the observer but should be adequately described by him so that it may be understood and enjoyed by many others. The description should not be "shallow rhapsodizing of the journalese and guidebook type, but true expression in which each noun exactly fits the object, each epithet is truly applicable, and each phrase rightly turned, and in which the emphasis is placed on the precisely right point, and the whole composed so as distinctly to bring out that point."

The address, which has set forth a high and admirable ideal, ought to serve as a timely antidote to the over-utilitarian form of geography which is now in vogue with educators probably on account of its vocational value. But the address leaves the reader in some uncertainty as to how far the beauty of a landscape is to be regarded as objective and inherent in the geographical reality, or subjective and evoked from the geographer's mentality. A solution of this uncertainty may be implied in the above-quoted opinion that an "understanding" of landscape beauty is well worth working for. If so, Younghusband should be regarded as a strong advocate of the explanatory description of land forms; for enjoyment grows enormously with their true interpretation, so much so indeed that a geographer who understands landscapes and recognizes the subtle meaning and relation of their parts finds beauty and charm in many a prospect that leaves an otherwise-minded observer unmoved. Even the barren landscapes of Tibet, with their uncounted alternations of rugged mountain ranges and smooth intermont plains, may have their "own particular beauty" to a traveler who is not blinded to their appeal by the difficulties of traveling over them. Nothing will help so much to struggle against blinding difficulties as a close scrutiny of the region around him in earnest and thoughtful search for the deep significance of its outward expression; that is, for the truth about it; and in just such measure as his search is rewarded will the real beauty of the region be perceived and the enjoyment of it grow. He will then feel more and more that "Beauty is truth, truth beauty."

W. M. Davis

GEOGRAPHICAL REVIEWS

Pioneer Studies of the West Patagonian Cordillera

Hans Steffen. **Westpatagonien: Die Patagonischen Kordilleren und ihre Randgebiete auf eigene Reisen gegründete Landschaftsdarstellung, verbunden mit einem Abriss der Erforschungsgeschichte des Gebiets.** Vol. 1, xiii and 358 pp.; maps, diagrs., ills.; Vol. 2, viii and pp. 359–670; maps, ills., bibliogr., index. Dietrich Reimer (Ernst Vohsen), Berlin, 1919. M. 60. 10 x 6½ inches.

The German colony which was planted in Chile by the grandfathers of the present generation, remains to this day characteristically German in customs and habits of thought, although intensely Chilean in national fealty. On a summer evening, when the band plays in the park of Osorno and the blond youths and maidens promenade decorously while the older people chat in true *Gemüthlichkeit*, it is hard to believe that one is not in Bavaria or Saxony. But Spanish mingles with or takes the place of the *Muttersprache*, and it is Chile, not the far-away Vaterland, for which young and old alike would fight. Also it is Argentina, not France, which is the hereditary enemy.

These facts are reflected in the work of Dr. Steffen, a Chilean of German parentage, on that part of Patagonia which he explored during the controversy between Chile and Argentina over the position of the boundary that should divide their respective dominions. The work is a retrospect, published seventeen years after the last of nine journeys undertaken between 1892 and 1902. It is marred throughout by the bitterness of the international dispute which prejudices the author against the similar work performed by the Argentines. It is, nevertheless, a record of original and in many localities initial observation, presented with characteristic German attention to detail.

The boundary dispute between Argentina and Chile, during the period from 1881 to 1902, concerned the interpretation of the treaty of 1881, which established two conditions to be fulfilled by the dividing line: it should follow the crest of the high Cordillera of the Andes and also the divide of the waters. Since the high crest and the divide do not agree, the commissioners espousing the interests of their respective countries disagreed. The Argentine commissioner was Francisco P. Moreno, explorer, geographer, and scientist. He utilized all the resources of the La Plata Museum, which he had founded and organized with the purpose of developing it into a Latin-American Smithsonian, to explore and survey the disputed territory. The resulting maps were used by the English arbitral commission, and Moreno was awarded the gold medal of the Royal Geographical Society for the contribution which he and his assistants had made to geographical knowledge.

Moreno's geographical contribution was in the same class as that of Hayden, Powell, and Wheeler in the United States. As their maps are being replaced by detailed surveys, so in time will his; but they must ever be regarded as remarkable results, achieved by intrepid explorers, inspired by the genius and indomitable purpose of their chief.

Dr. Steffen himself tells us what was the situation in Chile:

"The Chilean expert, Diego Barras Arana, historian and diplomat rather than geographer, would recognize only the continental divide as the governing fact by which to interpret the boundary treaty and its later protocols, and he subordinated to that concept all other orographic conditions, even indeed the requirement that the boundary should run 'in the Cordillera de los Andes' . . . In fact, according to the Chilean view the boundary question never was a truly geographical problem; it was rather a question of the analysis of the treaty and the subsequent delimitation on the ground according to the adopted principle, which should govern under all conditions. . . Nevertheless, the Chilean expert could not shut his eyes to the fact that exact knowledge of the geographical relations of the disputed zone would be advantageous, indeed often indispensable, and it was on this ground that I [Dr. Steffen] secured consideration from him when I proposed to the Chilean government that an exploring expedition should be organized."

The task which Dr. Steffen set himself in 1892 was matched in difficulty and uncertainty only by similar explorations undertaken in Alaska from 1896 on, by the United States Geological Survey. He proposed to ascend the Andean rivers to their distant sources, to determine their courses and the true position of the continental divide. The approach to the mouth of any stream was through fog-enshrouded, often uncharted fiords. A landing was to be made on delta flats in forest swamps, or the swift current of the river was to be stemmed until, on reaching impassable rapids, the party should take to the trackless and frequently precipitous mountain side. Fiord-like lakes interrupted the rivers' impetuous fall. Sheer cliffs rose from the water and sank far below its surface, forbidding passage by shore. To traverse the lakes and cross the rivers folding boats were carried; but each craft required at least three carriers, adding seriously to the number to be fed. Provisions spoiled. The men, enduring wet, cold, and excessive labor, shrank from the ever-increasing difficulties of advance into the ice-covered heights of the Andes and were tempted by the comparatively easy retreat. The Chilotes or natives of the island of Chiloé, from whom the laborers of these expeditions were largely recruited, are akin to the Eskimos in stature, physiognomy, and temperament. Strong, enduring, and willing when pleased, they may become sullen or frightened like children. It then requires great tact to lead them further.

That under these difficulties Dr. Steffen successfully carried out nine arduous expeditions, that he persevered to the limit of human endurance, that he was repeatedly accompanied by the same crews, all goes to demonstrate his qualities as a man and a leader.

The geographical content of these volumes possesses the value of original detailed description. The author describes his own observations and experiences in tracing the river systems of the Cordillera, from latitude 41° southward. He divides the Andes into five sections which, beginning at the north, he designates according to the principal watersheds as the Llanquihue Cordillera between the Gulf of Reloncavi and Lake Nahuel Huapi, the Puelo Cordillera, the Yelcho-Palena Cordillera, the Cisnes-Aisen Cordillera, and the southern section of West Patagonia. Each section is treated under chapter headings corresponding to the history of exploration, general description, and detailed accounts of individual features, particularly of drainage systems.

The work is accompanied by a general map, scale 1:2,500,000, and by five route maps, scale 1:250,000. The streams are crudely traced on these maps, even where they have been followed, the characteristic meanders and angles being lost. The relief is shown by conventional brush shading, without any attempt to express even the most evident of the grander forms of the mountains. No effort appears to have been made to raise these maps above the standard of the author's original reconnaissance sketches, even in the regions where more accurate surveys have been executed, as for instance in the vicinity of Lake Nahuel Huapi and the interior valley south of it.

The author, in the course of his various expeditions, noted the distribution of the massive granite rocks, the basic lavas, the schists and the Tertiary sediments of the Andes and presents the facts at some length in an introductory chapter as well as in several geological sketches. He discusses the tectonic divisions of the Cordillera, chiefly to emphasize the unity of the mountain uplift in contradistinction to the concept of a main Cordillera flanked by an eastern pre-Cordillera, as described by F. P. Moreno.

The American student of physiography will look in vain in these volumes for any recognition of the facts and principles of landscape evolution as they are understood by him. The author indeed cannot be held responsible, but the lack of observation and interpretation of topographic forms is none the less regrettable. In order to comprehend the strange courses of the rivers which he followed with such indefatigable energy, he would have required that knowledge of physical features by which to distinguish the elements of the Pliocene and post-Pliocene history; namely, (1) the ancient topographic surface of post-mature relief which he wandered over near El Cerro Tronador and in which the Paso Raulies and Paso Bariloche mark old valleys; (2) the drainage captures which ensued upon the initial upwarping of that old surface and which transferred the headwaters of the principal rivers such as the Rio Manso, Futaleufu, and others from Atlantic to Pacific watersheds; (3) the erosion of deep canyons as a result of further uplift; (4) the deepening of those canyons and their transformation into fiords or fiord-like lakes by glaciation; (5) the discrimination of the effects of the older and younger epochs of glaciation and their minor influences upon the drainage system; (6) the effects of faulting in determining the positions of longitudinal valleys where they exist, as in the Lago Mascardi-Valle Nuevo trough. These facts have been recognized as essential elements of Cordilleran history in the section of the Andes lying around and south of Lake Nahuel Huapi as far as Diez-y-seis de Octubre, and there can be no doubt that a similar interpretation will eventually apply to all the chain. The work before us belongs, however, to the class of empirical descriptions characteristic of the period before the key to physiographic interpretation had been discovered.

The general reader will, nevertheless, find in these pages a large amount of historical and geographical information and will enjoy the numerous excellent photographs which embellish the volume.

BAILEY WILLIS

THE NORTHEAST FRONTIER OF INDIA

L. W. SHAKESPEAR. **History of Upper Assam, Upper Burmah, and North-Eastern Frontier.** xvii and 282 pp.; maps, ills., index, bibliogr. Macmillan and Co., Ltd., London, 1914. $3.25. 9 x 6 inches.

Wherever the officers of the British Army have gone they have placed the sciences of geography and history under a deep debt of gratitude. Some of these energetic British have produced masterpieces, such as the travels of Younghusband; others have written racy volumes of a rather shallow nature; but the majority have given us painstakingly accurate works which show a deep and abiding enthusiasm but are obviously the work of amateurs both in science and in the art of writing.

The book under discussion is of this last kind—valuable and indeed indispensable to the student of northeastern India, decidedly interesting in spots, but somehow a little confusing. The writer feels the lure of the dense forests, the mighty mountains, and the childlike, irresponsible savages, but finds it hard to impart it to the reader.

The opening chapter puts before us the most absorbing of all problems in a country like Assam and Burmah—the cause of the striking contrast between a great past and a degenerate present. Three centuries or more before Christ the people of Assam were so civilized and energetic that they built stone cities like Kamatapur nearly nineteen miles in circumference. Today they are "a peaceful, almost effeminate race," few in number, addicted to opium, "and not disposed to diligent labor."

Colonel Shakespear suggests five reasons for this great change: (1) The moist, warm climate with its torrential rains soon enervates every race that enters the regions. (2) Frequent invasions from the north have overwhelmed the country again and again. (3) The Brahmaputra River has overwhelmed city after city. Between 1790 and 1860 it changed its course by no less than 50 miles. (4) Earthquakes are common here at the foot of the young Himalayas and have overthrown many of the ancient ruins. (5) The vegetation is so extremely dense that it quenches human ambition. Moreover, it is constantly spreading, and much that was open, cultivated land only a few centuries ago is now covered with almost impenetrable forest.

After so promising an introduction the reader hopes to find a real discussion of the points thus raised. Instead he finds chapter after chapter of minute details as to tribal wars and especially as to the various expeditions which ultimately resulted in the present system of British rule. Incidentally, to be sure, many interesting notes are introduced dealing with social, political, and religious customs. For example, in Bhutan, previous to 1842, there was for a while an odd arrangement whereby the district of Kalling was under native rule eight months of each year and under British rule the remaining four.

A chapter on ruins describes a most extraordinary series of great monoliths, some roughly hewn and suggesting a tropical Stonehenge; others beautifully carved. At Dimanpur a field of 64 elaborate monoliths, set in a background of wonderful forest, is remarkably suggestive of the Maya ruins at places like Quirigua in Guatemala. In fact no feature of Assam and the neighboring regions to the southeast is more striking or more puzzling than the close parallelism with the similar climatic region from southern Mexico southward. This parallelism displays itself not merely in the general decline in civilization but in the tendency toward massiveness in architecture, toward monoliths set up in rows, toward phallism when decadence set in, and in many other respects.

One of the most interesting parts of the book is the account of the curious customs of the Nagas and their neighbors, some of whom hunt heads as trophies while others hunt them merely to imbibe the strength of the decapitated victim. Where the author describes his own journeys he attains a vividness which is lacking elsewhere. The pictures are admirable, many being of unusual scenes such as the amazingly flimsy bridges of light canes which swing across the raging Himalayan streams.

The author himself apparently feels that one of the most important parts of the book is the suggestions as to reforms in British methods of dealing with wild tribes. When a tribe commits depredations Colonel Shakespear advocates a quick, sharp punitive expedition, followed at once by road-building and the opening up of commerce. He also urges the payment of subsidies to influential natives to establish, as it were, a cordon of friendly wardens of the marches. Although he does not say so, his idea is "Speak gently and carry a big stick."

Ellsworth Huntington

A Synthesis of Our Knowledge of Southern Tibet

Sven Hedin. **Southern Tibet. Discoveries in Former Times Compared with My Own Researches in 1906–1908.** Vol. 1, xxxii and 293 pp.; maps, ill.: Vol. 2, xi and 330 pp.; maps, ills.; Vol. 3, xi and 369 pp.; maps, ills.; each 11 x 9 inches. **Atlas of Tibetan Panoramas,** 105 pls. (552 drawings), 15 x 12 inches. [**Portfolio of**] **Maps,** 1, 15 pls., 15 x 12 inches. Lithographic Inst. of the General Staff of the Swedish Army, Stockholm, 1917. $200.00.

These volumes, Hedin says, are the scientific account of his explorations in southern Tibet, his popular account having been published earlier. They have no index, and it would be difficult to find all they contain relating to any particular topic if it were not for the well-arranged table of contents in each volume. Logical arrangement of topics and clear, simple, interesting treatment of them are among the best features of this enormous production.

No field worker in geography has means of his own with which to finance the publication of so regal a work as this. Its price indicates that no expense has been spared to make it a conspicuous product of the press. Its publication in this form was made possible because the Swedish Diet authorized most of the expenses from the public funds. A fourth volume is under preparation.

These volumes include an able analysis of the work of all explorers who have endeavored to reveal the remote and unknown regions of southern Tibet. An attempt is made to sum up all phases of the work and to show southern Tibet as it now is. Of course there are limits to one man's ability to do all this, and Hedin claims nothing more than that he in some measure "has opened the way for future conquests in Tibet on the different fields of scientific research." He has certainly achieved much.

The first volume is given to the beginnings of our knowledge of southern Tibet and to the ancient maps of Tibet and of the great Indian rivers that head in that country. This volume includes 53 maps dating from the fifteenth century to 1830, when the Chinese map of Tibet was published. They constitute a fine record of the gradual progress made in our knowledge concerning a very difficult region and of the slow improvement in methods of cartographic delineation during five centuries. Hedin makes many comments on the maps and on the geographical opinions and methods of the early days.

The second volume deals with modern exploration in southern Tibet, and nearly half of it is given to the Tsangpo River and its source. Some readers may recall the fact that, for generations, the source and the outlet of the Tsangpo were among the conundrums of Asian geography. It remained for Hedin to discover its source and to prove, as had already been suspected, that this great Tibetan river is really the upper Brahmaputra. The headwaters of the Brahmaputra are thus hundreds of miles to the west of the region within which, even less than a generation ago, the river was supposed to have its rise. In this territory, as in all others, Hedin combines with his own work the results, good or inferior, of the work of his many predecessors in the same field, thus giving in broad outline a comprehensive view of all geographical activities in every region as far as geographical history records them.

In the third volume the author concludes his history of all that was known of Tibet down to 1906; and the latter half of the book is given to his own journeys, describing in considerable detail each of his eight crossings of the Trans-Himalayas that have contributed in an important degree to our knowledge of this gigantic mountain system. He had to see everything himself, as he could not depend upon any native statements. He regards his work among the mountains as merely a pioneer effort, and it remains for future explorers to fill in the details.

Besides the reproduction of numerous old and later maps and of maps drawn by himself, the volumes contain a large number of exquisite half-tones and of views in color.

Accompanying the volumes is a "General Map of Central Asia and of Tibet," in colors, by Hedin, scale 1:7,500,000; 2 sheets of a "General Map of Eastern Turkestan and Tibet," in colors, 15 sheets, scale 1:1,000,000; and 12 sheets in colors showing the topography on both sides of Hedin's route, scale 1:300,000. These route sheets well illustrate a phase of the remarkable activity of this explorer, which is even more vividly accentuated in his "Atlas of Tibetan Panoramas." The atlas contains 552 sharply defined pen-and-ink sketches, chiefly of mountain ranges or bits of plateaus, with frequent notations along each panorama showing the bearings of the place as indicated from the draftsman's position.

These volumes and the Hedin maps are a most creditable achievement of one of the great geographers of the time.

Cyrus C. Adams

A Scientific Journey in the Hwangho Region of China and Tibet

Albert Tafel. **Meine Tibetreise: Eine Studienfahrt durch das nordwestleiche China und durch die innere Mongolei in das östliche Tibet.** Vol. 1, xi and 352 pp.; map, diagrs., ills.; Vol. 2, 346 pp.; map, diagrs., ills., index. Union Deutsche Verlagsgesell., Stuttgart, Berlin, Leipzig, 1914. M.24. 10 x 7 inches.

Dr. Tafel started on his journey, in the middle of China, in March, 1905, and was three years on his way through China and the eastern part of Tibet and back, the entire journey without white companion. His book is unusual in some respects and presents many facts and deductions so clearly that it is easy to grasp and assimilate them. The reader can see what the author describes, and the text is reinforced by a large number of superb half-tone illustrations. The forms of the land, the denudation wrought by natural processes, and other geographical types are clearly defined. So, too, is human life in its various forms—the homes, the industries, and the well-being or misfortunes of the peoples he met.

In the author's four years' journey he traced in China and Tibet more than two-thirds of the course of the Hwangho. His folded panoramic views, both in western China and in Tibet, are unsurpassed, though Sven Hedin shows a larger variety of superb views of Tibetan landscapes and phases of human and other life in his "Southern Tibet," 1917, discussed above. Tafel's studies of the northwestern part of China are more intensive than those he made in Tibet, partly because that remote section of China is still open to scientific research on a large scale and partly because such danger as environed his party in Tibet did not distract his attention in China.

Friendly Tibetans, near the eastern border of their country, had grave misgivings when they found that the explorer hoped to penetrate far into the land. For many weeks, however, he was kindly received. He noted, at first, the clearness of the air and the fact that he could see small objects at great distances. In a valley 15 miles away he saw moving white specks which his glass revealed as sheep feeding on the yellow grass. Many antelopes and other animals were wandering over the plains, for Tibet is not a dead country, but is full of life. He would have been glad to turn his own animals out to graze, but he was in a barbarous land and robbers would have stolen them.

As the explorer reaches monastery towns or the thinly scattered huts of the people, he tells what is known of the history of that part of the Mongol race which settled in Tibet and were the ancestors of the present inhabitants. The greatest influence there is Lamaism, a corrupt form of Buddhism; and it is partly their religious faith that has made the people so intolerant of the presence of strangers in their land. Gumbum, their largest monastery center, is a rather imposing walled town with a large population, including many hundreds of priests. During the religious festivals, thousands of pilgrims from all over Tibet are assembled at Gumbum.

The explorer did not completely cross Tibet from east to west as he had hoped to do. He did not see Lhasa, the chief town, though he was far on his way to it. He had made good progress for some months in temperatures that were usually below the freezing point. But his hopes were finally blasted in an hour. At Camp No. 88 his party was attacked at night by mounted Tibetans who surrounded the expedition, wounded one of his men, drove off his baggage animals, and sped away carrying with them some of the most important articles of his equipment. There was nothing to do but to retreat. Fortunately, the party had eight draft yaks left, enough to carry all the more important part of their remaining equipment, and they retained their guns and ammunition. So they turned back, taking a more southerly route; and Tafel resumed his studies of the country around him. The party suffered, at times, from hunger but more from cold. Snow averaging a foot in depth made travel arduous.

Cyrus C. Adams

THE SAN JUAN DISTRICT, PORTO RICO: ITS PHYSIOGRAPHY AND GEOLOGY

D. R. SEMMES. **The Geology of the San Juan District, Porto Rico.** Map, diagrs., ills., bibliogr. Scientific Survey of Porto Rico and the Virgin Islands, Vol. 1, Part I, pp. 33–110. N. Y. Acad. of Sci., 1919.

The above geological report, published by the New York Academy of Science as part of its "Scientific survey of Porto Rico and the Virgin Islands," begun in 1914 and conducted jointly with the Porto Rico government, deserves the attention of geographers if only for the excellent quality of its second paragraph. The first paragraph briefly explains that the district described lies in the northern half of the island, of which it is typical, the second compactly states: "The physiographic history of the San Juan district is that of a complex mountainous oldland, which has been peneplained, partially submerged, overlapped by a coastal plain, uplifted, maturely dissected, again slightly submerged and partially uplifted, erosion continuing in the interior from the time of the first uplift." Thus the reader immediately acquires at the outset a general concept of the area studied, upon which a multitude of refining details are embroidered in the following pages. As the object of the study was geological, the quoted statement is phrased historically; but a geographical paraphrase can be easily prepared from it.

The mountainous oldland is "merely the eroded crest of a submerged mountain range of great complexity and magnitude," its axial altitude being about 2,500 feet. In the interior it has "attained the maximum ruggedness characteristic of a fully mature stage in topographic development;" its form there is "predominantly that of the ridge or *cuchilla* [knife] type," the minutely ravined slopes of the ridges descending at angles of 30° or 40° into close-placed, V-shaped valleys of dendritic (insequent?) arrangement, at the head of which the streams still have cascades. Yet a broad view shows that the innumerable ridges possess a general accordance of crest-line altitudes, as if they had been carved in a possible uplifted peneplain, of which occasional undissected uplands are taken to be remnants. Surmounting elevations, from 3,600 to 3,800 feet in altitude, are regarded as monadnocks. The rocks of the oldland yield various metals, including gold and platinum, in small quantities. Of special significance in the rock composition is the small proportion of quartz. Weathering gives rise to a very impervious clayey soil. It is to this fact that the remarkable stability of the soil mantle may be attributed. Hillsides that slope as steeply as 40° are susceptible of cultivation with little loss of soil. The northward decline of the mountains leads to their disappearance with decreasing relief beneath the coastal plain; but their marginal altitudes vary so greatly that the peneplain thereabouts was either not well developed, or has suffered later warping.

The coastal plain has a belted relief. Adjoining part of the mountain border is a longitudinal inner lowland, excavated along the strike of weak clays and marls, the basal members of the coastal plain series. Next comes a dissected cuesta maintained by relatively resistant limestones, in part of coral reef origin. Where best developed, the cuesta inface rises abruptly from the inner lowland. The cuesta upland is elaborately dissected, showing many small, isolated, or "haystack" hills rising over plain areas that stand in terrace-like arrangement at lower and lower levels toward the coast. There are many caves in the limestone hills, some of which contain bat guano, locally used as a fertilizer. In consequence of slight changes of level since its erosion, the dissected coastal plain has an irregular outer margin, which is adjoined by lowlands or playa plains several miles in width, formed of outwashed detritus. Their surface being only a few feet above sea level, they are occasionally flooded by heavy rains and on-shore hurricanes. The playa plains are occasionally interrupted by low, isolated outliers of the partly submerged coastal plain; their outer margin is bordered along the shore by a belt of low sand dunes which, formed as an offshore sand reef, may have preceded and aided the formation of the playa plains. Until recently the playa plains were largely covered with swamp, but, "since the value of the land has been recognized for sugar-cane production, all the available areas have been drained and now constitute the most productive and valuable lands on the island." The city of San Juan lies on the western extremity of an offshore belt of consolidated sand dunes that encloses a lagoon harbor.

W. M. DAVIS

Farm Types in Nebraska

R. R. Spafford. **Farm Types in Nebraska as Determined by Climate, Soil, and Economic Factors.** *Agric. Exper. Sta. Research Bull. No. 15.* Lincoln, Neb., 1919.

Type areas for study in this bulletin are based primarily on temperature and rainfall and secondarily on soils. "Considered on any large geographical scale," says the author, "soil effects are often submerged by climate. The reverse is true in comparatively small areas of agricultural land. Here variations in soil often have sufficient range to outweigh the comparatively small range of climatic variations." Annual crop groups are largely limited by temperature. They fall into three main groups: (1) fall or winter, (2) spring, and (3) summer annuals. Winter annuals are seeded in the winter, spring annuals are seeded in late winter or early spring, and summer annuals are seeded in late spring or early summer.

The unit for crop temperature is the *month-degree.* This is determined by adding the total normal mean monthly temperatures above freezing and subtracting from this sum the product obtained by multiplying 32 by the number of months having mean monthly temperatures below freezing. In Nebraska the crop group areas, whether spring-summer, winter-spring, etc., show a general east-west grouping and vary from south to north roughly with the insolation. The comparative uniformity of altitude and other secondary climatic factors in this state makes the grouping relatively simple.

Rainfall in Nebraska decreases from 32 inches in the east to 16 inches in the extreme west. It is found that the size of farms increases with decrease of rainfall; for low rainfall produces low crop yields and short pastures, and larger acreages are therefore necessary to provide yields equal to those of eastern Nebraska. Thus in the eastern counties the average farm varies in size from 171 to 229 acres, while in the High Plains of the extreme western part the farms average 1,129 acres; in the western Sand Hills Region, which is both dry and sandy, the farms average 1,781 acres.

Mr. Spafford, who is now a member of the U. S. Bureau of Farm Management, has produced an interesting and valuable study of the relations of geographic factors to rural economics and sociology, a study which might well be followed in other states. Despite the title, very little attention is given to soils, and they are not described when mentioned; a general soil map of the state would be very useful. The bulletin is "meaty," and in places close attention is necessary to follow the author; but the numerous graphs are of much aid in presenting many facts in condensed form. Although the treatment is not formally geographical, this bulletin, not only in its subject matter but also in the method of approach to the problems, is a valuable contribution to geography.

F. V. Emerson (deceased)

A Primer of Tropical Hygiene

J. W. Ritche and M. A. Purcell. **Sanitation and Hygiene for the Tropics.** With an introduction by D. P. Barrows. xi and 434 pp.; diagrs., ills., index. World Book Co., Yonkers, 1918. $1.00. 7½ x 5½ inches.

No more beneficent work can be done in the public schools than to teach well the laws of health and sanitation. In a tropical country the work is doubly needed. This volume was written primarily to conserve health and to decrease illness in the Philippine Islands. In consequence, its illustrations are drawn largely from the Islands, and it lays particular emphasis on diseases which are endemic there—malaria, tuberculosis, leprosy, cholera, and smallpox. The volume is divided into two sections. Book I unfolds for the pupils of the Philippine schools the germ theory of the various diseases with special directions as to the way to avoid contagion. It is a book of first aid and simple treatments, simply stated and carefully and effectively illustrated. Book II is a treatment of physiology and hygiene, an appeal through the knowledge of the body and its functions for the proper use and care of it. The entire treatment is well adapted for school use, and the authors are to be congratulated on their success in organizing and presenting so much valuable material interestingly enough for immature minds. Editions of this same book adapted to the United States proper have been issued under the titles of Primer of Sanitation, Primer of Hygiene, and Primer of Physiology.

Robert M. Brown

THE WORK OF THE BRITISH RAINFALL ORGANIZATION

H. R. MILL AND C. S. SALTER. **On the Distribution of Rain in Space and Time Over the British Isles During the Year 1918 as Recorded by About 5,000 Observers in Great Britain and Ireland, and Discussed with Articles Upon Various Branches of Rainfall Work.** 242 pp.; maps, diagrs., ill. *British Rainfall,* Vol. 58, 1918. Edward Stanford, Ltd., London, 1919. 8½ x 6 inches.

On July 25, 1919, the responsibility for the management of the British Rainfall Organization was transferred by the Trustees of that body to the Director of the British Meteorological Office. According to the terms of the transfer, the publication of *British Rainfall* will be continued under the auspices of the Meteorological Office. The present volume is, therefore, the last of the long series to appear as the independent publication of that unique rainfall organization which has done such important work ever since its foundation by the late George J. Symons. The present issue appropriately contains, as its frontispiece, an excellent half-tone portrait of Dr. Mill, who has now retired as Director of the British Rainfall Organization. The *Review* has already contained (September, 1919, pp. 194–195) an account of the important features of the rainfall of 1918. We may, however, here call attention to Dr. Mill's appreciative and very personal account of the development of the British Rainfall Organization since 1910; and to Mr. Salter's study of the relation of rainfall to configuration. The usual complete and well-arranged tabulations and critical discussions occupy the larger part of the volume.

Meteorologists the world over have distinct cause for congratulation in the fact that the British Rainfall Organization is to be continued on a firm basis, as part of the Government's scientific activity, and that *British Rainfall* will appear as the regular annual publication of that service.

R. DeC. WARD

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